BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAI‘I

In the Matter of the Application of HAWAIIAN ELECTRIC COMPANY, INC. for approval to commit funds in excess of $2,500,000 (excluding customer contributions) for Project Item PZ.005089, Kulanihakoi Substation Project, and to recover costs through the Major Project Interim Recovery Adjustment Mechanism.	)))))))))))	Docket No.

APPLICATION OF HAWAIIAN ELECTRIC COMPANY, INC.

VERIFICATION

EXHIBITS 1 - 15

and

CERTIFICATE OF SERVICE

BOOK 2 OF 2

Joseph P. Viola
Vice President
Regulatory Affairs
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawai‘i 96840

TD/G

January 27, 2020

Ms. Tracy Tonaki
Vice President, Purchasing & Design

Mr. Alan K Arakawa
Sr Vice President, Planning & Acquisitions
D.R. Horton
130 Merchant Street, Suite 112
Honolulu, Hawaii 96813

Dear Ms. Tonaki and Mr. Arakawa:

Subject: **Hoopili Substation #1 - 46kV Line Extension**
<u>Query for the Cost to Underground</u>

In accordance with Hawaii Revised Statutes §269.27.6(a)(3), Hawaiian Electric Company, Inc. (HECO) is requesting whether government agencies or other parties are willing to pay for the additional costs of undergrounding the electric lines for the subject project.

This project involves the extension of the Ewa Nui 42 and Waiau Steel Mill 46kV circuits to feed the proposed Hoopili Substation in Kapolei, Oahu as indicated on the attached drawing. The scope of work involves the replacement of four (4) existing poles and the installation of sixty-nine (69) new poles and approximately 2.5 miles of sub transmission lines, and the relocation of 0.2 miles of distribution lines.

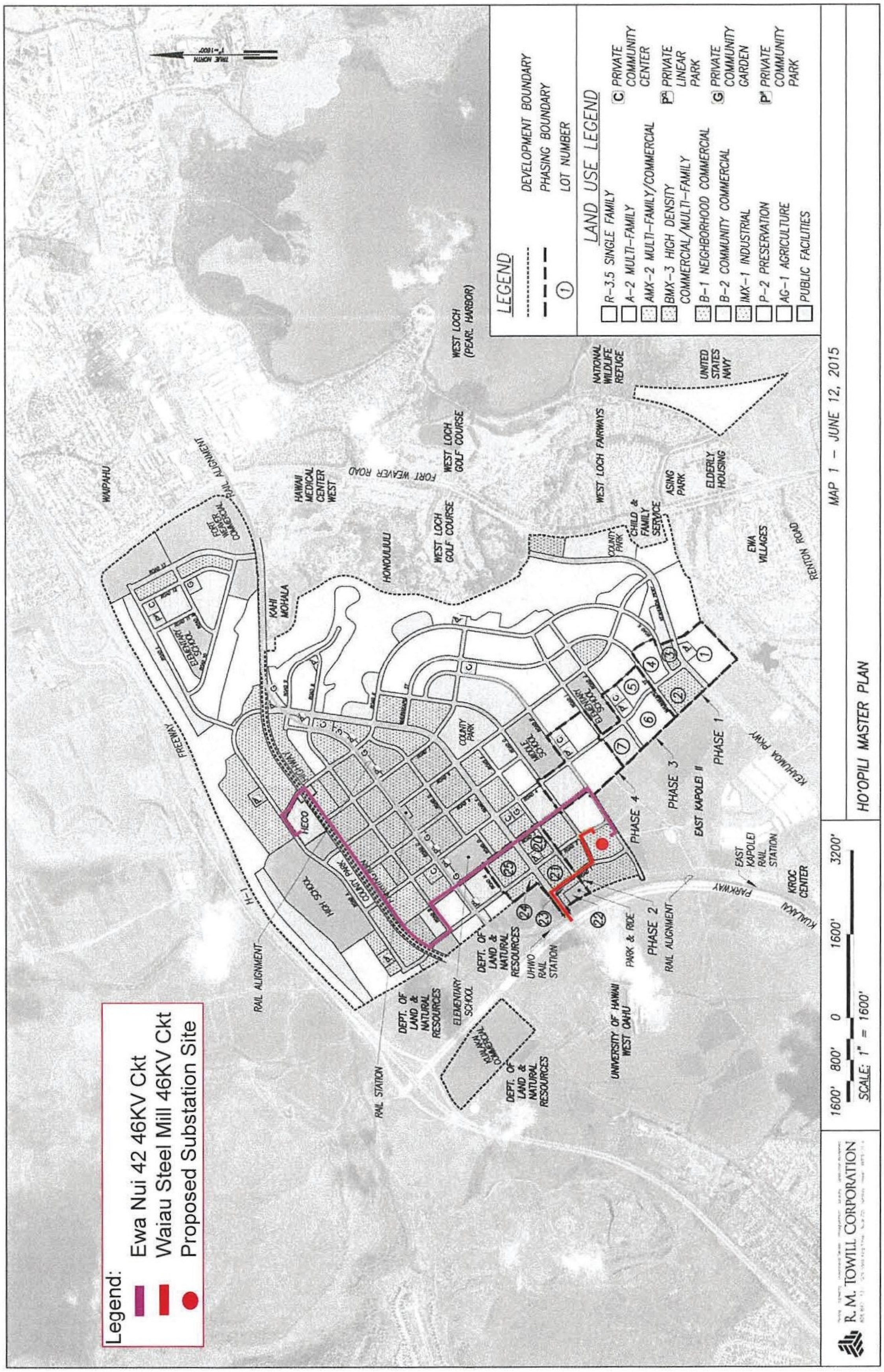
The estimated cost for the 46kV overhead line for this project is $3,500,000. The estimated cost for a 46kV underground alternative is $25,600,000. The underground route follows the same route as the proposed overhead relocation. **Please notify Hawaiian Electric by February 28, 2020** if D.R. Horton is interested in paying the additional costs of undergrounding this 46kV line as described above.

Thank you for your attention on this matter. Donna Mizuba is the engineer assigned to this project. If you have any questions, please call her at [redacted].

Sincerely,

Kerstan J. Wong
Director
Transmission & Distribution Engineering

Attachment
cc (email): Steve Sakai (Ronald N.S. Ho & Associates, Inc)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PARK & RIDE
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UNIVERSITY OF HAWAII WEST OAHU
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HO'OPILI MASTER PLAN
MAP 1 - JUNE 12, 2015
SCALE: 1" = 1600'
1600' 800' 0 1600' 3200'
TRUE NORTH
R. M. TOWILL CORPORATION

D·R·HORTON
America's Builder
HAWAII

February 27, 2020

Mr. Kerstan J. Wong
Director, Transmission & Distribution Engineering
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, HI 96840-0001

Subject: Hoopili Substation #1 – 46kV Line Extension
Query for the Cost to Underground

Dear Mr. Wong,

Thank you for your subject letter dated January 24, 2020 requesting a response to your query regarding additional undergrounding costs associated with the extension of the Ewa Nui 42 and Waiau Steel Mill 46kV circuits to feed Hoopili Substation #1.

It is our understanding that the scope of work involves the replacement of four (4) existing poles and the installation of sixty-nine (69) new poles and approximately 2.5 miles of sub transmission lines, and the relocation of 0.2 miles of distribution lines. The estimated cost for the 46kV overhead line portion of this work is $3,500,000. It is also our understanding that this cost is Hawaii Electric's responsibility as part of the System Substation Improvements. Hawaiian Electric has studied a 46kV underground line alternative and has estimated this cost at $25,600,000.

In response to your query, DR Horton is not interested in paying the additional costs of $25,600,000 to underground this 46kV line.

Should you have any further questions, please do not hesitate to contact me.

Sincerely,

Tracy Tonaki
Senior Vice President
[redacted]

cc: DR Horton – Alan Arakawa
Ron Ho & Associates – Steve Sakai

TD/G

February 18, 2020

Ms. Kathy K. Sokugawa
Director, Department of Planning and Permitting
City & County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Ms. Sokugawa:

Subject: Hoopili Substation #1 - 46kV Line Extension
Query for the Cost to Underground

In accordance with Hawaii Revised Statutes §269.27.6(a)(3), Hawaiian Electric Company, Inc. (HECO) is requesting whether government agencies or other parties are willing to pay for the additional costs of undergrounding the electric lines for the subject project.

This project involves the extension of the Ewa Nui 42 and Waiau Steel Mill 46kV circuits to feed the proposed Hoopili Substation in Kapolei, Oahu as indicated on the attached drawing. The scope of work involves the replacement of four (4) existing poles and the installation of sixty-nine (69) new poles and approximately 2.5 miles of sub-transmission lines.

The estimated cost for the 46kV overhead lines for this project is $3,500,000. The estimated cost for a 46kV underground alternative is $25,600,000. The underground route follows the same route as the proposed overhead installation. **Please notify Hawaiian Electric by February 28, 2020** if the City and County of Honolulu is interested in paying the additional costs of undergrounding these 46kV lines.

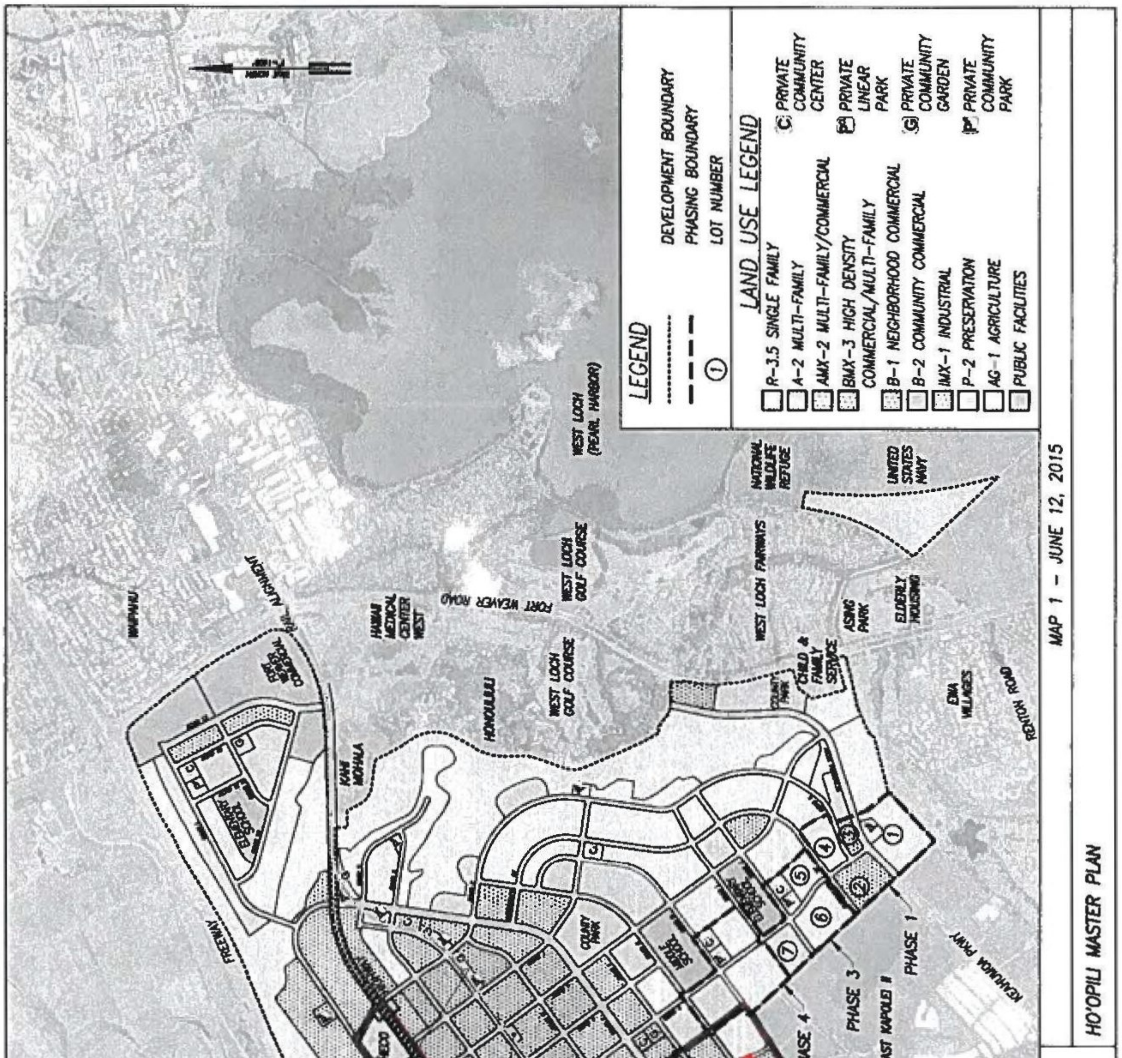
Thank you for your attention on this matter. Donna Mizuba is the engineer assigned to this project. If you have any questions, please call her at [redacted]

Sincerely,

Kerstan J. Wong
Director
Transmission & Distribution Engineering

DM/IML/JPO/MOL:lcm
Attachment

cc (email): Steve Sakai (Ronald N.S. Ho & Associates, Inc)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SCALE: 1" = 1600'
MAP 1 - JUNE 12, 2015
HO'OPILI MASTER PLAN
R.M. TOWILL CORPORATION

HART

HONOLULU AUTHORITY for RAPID TRANSPORTATION

IN REPLY REFER TO:
CMS-AP00-03779

March 13, 2020

Mr. Kerstan J. Wong
Director, Transmission & Distribution Engineering
Hawaiian Electric
P. O. Box 2750
Honolulu, Hawaii 96740-0001

Dear Mr. Wong:

Subject: HECO Letter dated February 18, 2020, to City and County of Honolulu Department of Planning and Permitting Director, Ms. Kathy Sokugawa
Ho'opili Substation #1 – 46kV Line Extension
Query for the Cost to Underground

On March 9, 2020, the Mayor's office forwarded to the Honolulu Authority for Rapid Transportation (HART) the subject letter dated February 18, 2020. In response, HART provides the following:

After review of the Ewa Nui and Waiau Steel Mill proposed routes, HART observed that the associated lines will not directly connect to either of the two HART stations (Keone'ae, Honouliuli) or the HART Traction Power Supply Substation in the vicinity of the Ho'opili Development. Accordingly, costs to underground this infrastructure would be considered betterments which, under federal law, HART cannot contribute towards.

Thank you for the consideration, however, HART respectfully declines.

Very truly yours,

Andrew S. Robbins
Executive Director and CEO

cc: HART Board of Directors
Mayor Kirk Caldwell
Ms. Kathy Sokugawa, Director
Department of Planning and Permitting

TD/G

January 20, 2020

Mr. Mark Yonamine, P.E.
Director, Department of Design and Construction
City & County of Honolulu
650 South King Street, 11th Floor
Honolulu, Hawaii 96813

Dear Mr. Yonamine:

Subject: Hoopili Substation #1 - 46kV Line Extension
Query for the Cost to Underground

In accordance with Hawaii Revised Statues §269.27.6(a)(3), Hawaiian Electric Company, Inc. (HECO) is requesting whether government agencies or other parties are willing to pay for the additional costs of undergrounding the electric lines for the subject project.

This project involves the extension of the Ewa Nui 42 and Waiau Steel Mill 46kV circuits to feed the proposed Hoopili Substation in Kapolei, Oahu as indicated on the attached drawing. The scope of work involves the replacement of four (4) existing poles and the installation of sixty-nine (69) new poles and approximately 2.5 miles of sub transmission lines.

The estimated cost for the 46kV overhead lines for this project is $3,500,000. The estimated cost for a 46kV underground alternative is $25,600,000. The underground route follows the same route as the proposed overhead installation. **Please notify Hawaiian Electric by February 28, 2020** if the City and County of Honolulu is interested in paying the additional costs of undergrounding these 46kV lines.

Thank you for your attention on this matter. Donna Mizuba is the engineer assigned to this project. If you have any questions, please call her at [redacted].

Sincerely,

Kerstan J. Wong
Director
Transmission & Distribution Engineering

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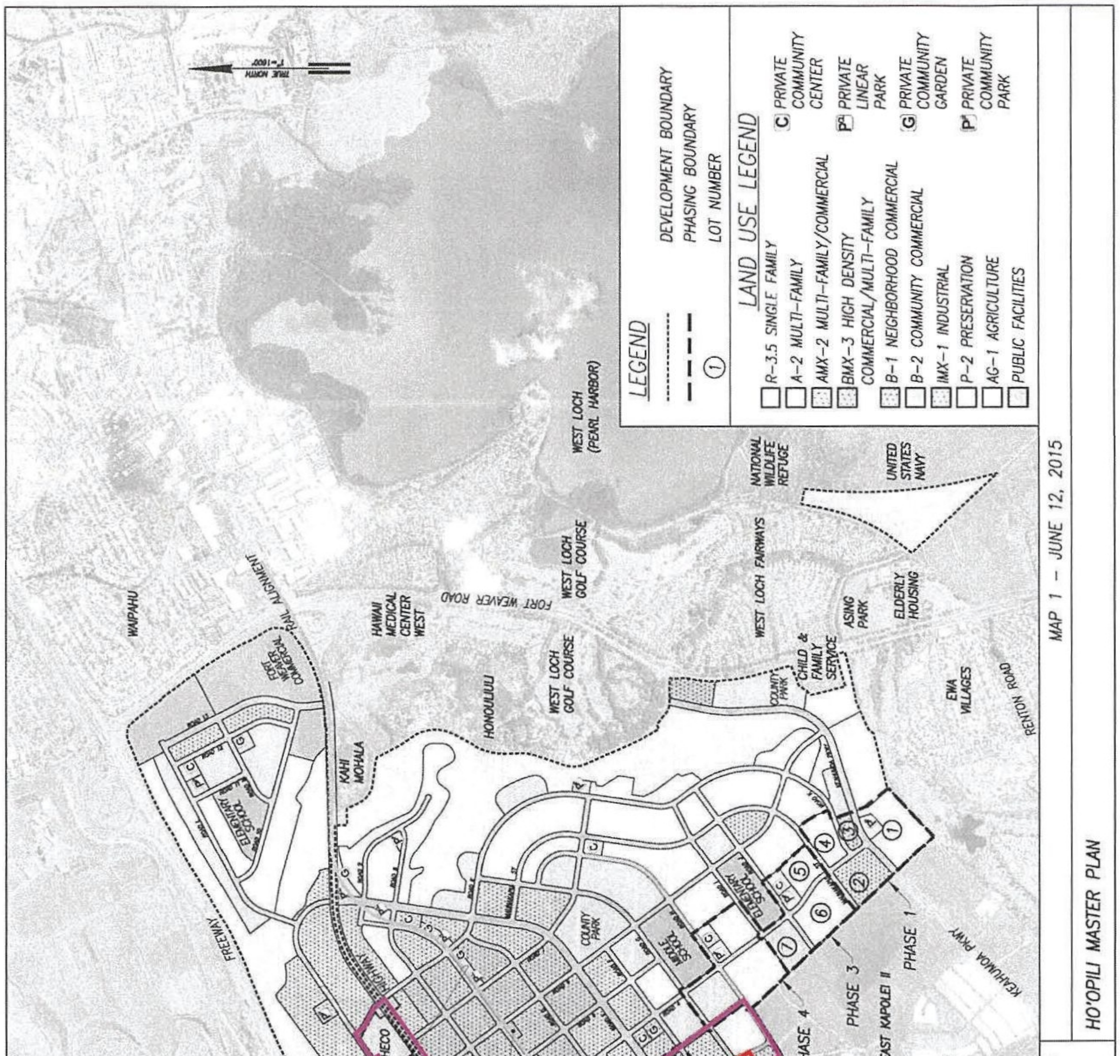
cc (email): Steve Sakai (Ronald N.S. Ho & Associates, Inc)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DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

KIRK CALDWELL
MAYOR

MARK YONAMINE, P.E.
DIRECTOR

HAKU MILLES, P.E.
DEPUTY DIRECTOR

February 3, 2020

Hawaii Electric
ATTN: Kerstan Wong
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Dear Ms. Wong,

Subject: Hoopili Substation #1 – 46kV Line Extension
Query for the Cost to Underground

Thank you for the opportunity to review and comment. The Department of Design and Construction does not have any comments at this time. Our Civil Division recommends that this letter be forwarded to the Department of Planning and Permitting as they may have requests for new developments to underground utilities.

Should you have any further questions, please contact me at [redacted]

Sincerely,

FOR Mark Yonamine, P.E.
Director

MY:ms(801222)

TD/G

January 27, 2020

Mr. Jade Butay
State of Hawaii
Director, Department of Transportation
Aliiaimoku Building
869 Punchbowl Street, Room 509
Honolulu, Hawaii 96813

Dear Mr. Butay:

Subject: **Hoopili Substation #1 - 46kV Line Extension**
Query for the Cost to Underground

In accordance with Hawaii Revised Statutes §269.27.6(a)(3), Hawaiian Electric Company, Inc. (HECO) is requesting whether government agencies or other parties are willing to pay for the additional costs of undergrounding the electric lines for the subject project.

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The estimated cost for the 46kV overhead line for this project is $3,500,000. The estimated cost for a 46kV underground alternative is $25,600,000. The underground route follows the same route as the proposed overhead relocation. **Please notify Hawaiian Electric by February 28, 2020** if the State of Hawaii Department of Transportation is interested in paying the additional costs of undergrounding this 46kV line as described above.

Thank you for your attention on this matter. Donna Mizuba is the engineer assigned to this project. If you have any questions, please call her at [redacted].

Sincerely,

Kerstan J. Wong
Director
Transmission & Distribution Engineering

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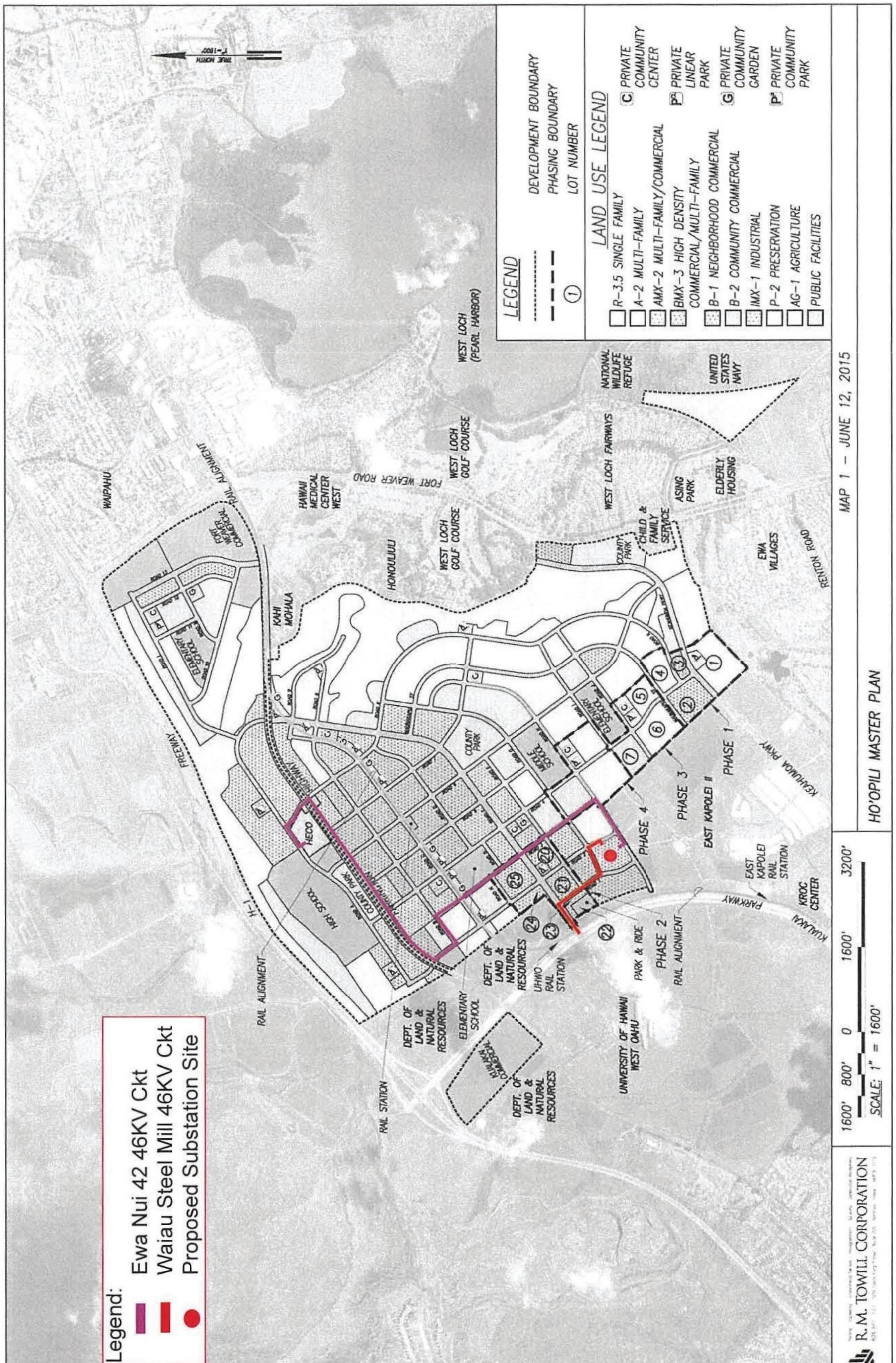
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Non-Wires Alternative ("NWA") Opportunities and Program Development Workplan

IGP Soft Launch RFP

The Integrated Grid Planning ("IGP") Soft Launch was a sourcing process described in the IGP Workplan[1] to help inform development of the full scale IGP planning and sourcing effort. The Soft Launch Request for Proposals ("Soft Launch RFP") were issued in accordance with the IGP Workplan and sought to acquire NWA resources while piloting sourcing processes and evaluation methods for distribution NWAs ("Soft Launch RFP").

The Company issued the Soft Launch RFP on November 8, 2019 seeking qualified NWAs[2] to provide Reliability (Back-Tie) Services to cost-effectively defer two distribution investments in the East Kapolei Area: (1) Kapolei 4 Circuit Extension and (2) Hoʻopili Substation. Per Section 1.2.1 of the RFP, for each of the deferral opportunities, all expected performance and operational requirements needed to be met to defer the planned investment. Proposals were due January 7, 2020.

In consultation with the Independent Observer, the Company announced on February 13, 2020 it would not move forward with the Soft Launch RFP because the proposals submitted did not meet the specified performance and operational requirements. As a result, the Company is moving forward with an application for the Hoʻopili Substation, as requested herein.

Learnings and Future Opportunities

Learnings from Soft Launch RFP

At the IGP Distribution Planning Working Group ("DPWG") meeting[3] held on March 9, 2020, stakeholders discussed learnings from the Soft Launch RFP. Suggestions from stakeholders for future opportunities included a programmatic solution and broadening the marketing approach for future NWA RFPs, particularly to encourage real estate and renewable energy developers to work together and bid more NWA projects. Further, experience gained from the Soft Launch RFP indicates that a variety of solutions (or portfolio of solutions) will likely be required to fulfill any future NWA project performance and operational requirements.

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[1] The RFP was issued in accordance with the IGP Workplan submitted by the Hawaiian Electric Companies on December 14, 2018, as accepted through Order No. 36218 issued on March 14, 2019 in Docket No. 2018-0165 by the PUC.

[2] A non-wires alternative is generally defined as an electricity grid project that uses non-traditional transmission and distribution solutions, such as distributed generation, energy storage, energy efficiency ("EE"), demand response ("DR"), and grid software and controls, to defer or avoid the need for conventional transmission and/or distribution infrastructure investments. See Docket No. 2018-0165, Hawaiian Electric Companies' Integrated Grid Planning Workplan, filed December 14, 2018, at 21.

[3] IGP DPWG meeting summary notes and presentation slides can be found at https://www.hawaiianelectric.com/clean-energy-hawaii/integrated-grid-planning/stakeholder-engagement/working-groups/distribution-planning-and-grid-services-documents.

The Company believes there will be opportunities for NWAs in the future, especially in areas with anticipated load growth or future development, such as East Kapolei. The Company is committed to exploring all pricing, programs, and procurement ("3 P's") solutions that can cost-effectively mitigate the impact of distribution overloads while maintaining performance and operational requirements. In addition, the Independent Observer committed to providing a recommendations report that can be used for scoping future procurements. With new feedback, the Company will continue to analyze options for NWA opportunities to address future growth.

Potential New NWA Pricing and Program Opportunities

A key learning from the Soft Launch RFP was the need to explore and develop a variety of resource acquisition methods, i.e. pricing, programs, and procurement to cost-effectively provide NWA opportunities for distribution needs. Specifically, in East Kapolei where additional load growth is anticipated due to new real estate development, these solutions could be used to mitigate impacts on the existing grid. Potential opportunities could include:

- **Time of Use Rates[4] –** All customers in NWA affected area would be required to take electric service under a TOU rate if they are not enrolled in another program.
- **Peak Pricing Program[5] –** A program to reduce peak time demand, may be supported by specific load modifying equipment, e.g. GIWH, t-stats, etc. Rebates for equipment may be coordinated with Hawaii Energy. Incentive or rate structure would reflect program parameters.
- **Localized Community Solar –** On April 9, 2020, the Commission issued Order No. 37070 in Docket No. 2015-0389 ("CBRE Order"), commencing Phase 2 of the CBRE Program, which directed the Companies to "use evaluation criteria to promote NWA to encourage and facilitate CBRE projects in locations that help defer or obviate conventional investments in transmission and distribution infrastructure."[6] The Company intends to leverage the CBRE procurement opportunity to assist in solving the distribution needs in the Kapolei area.
- **Solar + Battery Host Program** – A program consisting of customer-hosted utility-owned solar (photovoltaic or "PV") systems on their rooftops could be used to source NWAs in desired locations. Customer-hosted PV systems would be paired with customer-hosted energy storage systems or used in conjunction with nearby grid-scale energy storage. Customers hosting the systems would receive compensation.

In cases where load growth from new real estate development triggers a need for distribution upgrades (such as increasing substation capacity), the Company would partner with developers to incorporate solutions into new developments. Developers may be able to support NWA opportunities by setting aside land for a Localized Community Solar site, pre-installing and configuration of rooftop PV, EV chargers, or programmable, controllable thermostats, etc. These solutions could be particularly viable in affordable housing developments for low and moderate income ("LMI") customers. Specifically, the Solar + Battery Hosting program provides an opportunity to install PV and energy storage systems without, further increasing housing prices for the customer. Real estate developers have provided feedback to the Company that any NWA program must consider that a top priority for the developer is

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[4] See Docket No. 2019-0323, DER Policies Companies' Advanced Rate Design Strategy at 13-14, 23-25 filed on September 25, 2019.
[5] *Id.* at 13, 24-25.
[6] CBRE Order at 26.

to not increase the cost of the construction of the home; particularly where the goal is to build and sell affordable housing.

Theoretically, NWA opportunities could exist for all new real estate developments, regardless of whether there is a need for distribution upgrades or not. However, for this initial effort, the Company will focus on building partnerships with real estate developers and their construction contractors to determine the best opportunities and solutions for East Kapolei. The learnings and experiences gained from NWA East Kapolei project(s) will be utilized in the next NWA effort as discussed below in this workplan.

NWA Opportunities Work Plan

The Company believes that new NWA opportunities will emerge in the East Kapolei area. Research and investigation must be performed in conjunction with stakeholders to gather information and develop options. This outline has been developed to communicate the key components of the Workplan. The following reflects the general sequence of activities that need to be performed to develop recommended solutions:

1. **Assess needs.** A grid needs assessment will be conducted based on anticipated future load growth. The Company will engage the developer in discussions to understand the timing, magnitude, and location of the load growth. Additionally, large customers in the area will be approached to gather information about their future load projections for inclusion in a total grid needs assessment for the area. Specifically, for the Ho'opili development and East Kapolei area, the grid needs will be reassessed to reflect any changes to future load growth projections since the Soft Launch RFP was issued. This will include evaluating the impact of recent events such as COVID-19 on forecasted load projections and future development schedules.

2. **Identify options.** NWA options that are able to fulfill the grid needs determined in the need's assessment will be identified. All options will be considered, including but not limited to existing rates and CER programs, energy efficiency, and development of new programs. This step will require engaging and collaborating with developers and stakeholders, such as Hawaii Energy. Specifically, for this case, a forecast of solar photovoltaic ("PV") and electric vehicle adoption in East Kapolei will be required. Additional considerations will include the potential for or currently proposed institutional or commercial building plans to incorporate energy efficiency, electric vehicle charging, and development of site plans for CBRE.

3. **Evaluate options.** Options identified in the previous step will be evaluated on ability to meet the identified grid needs. Options may be screened at a high-level for technical feasibility, cost-effectiveness, and community acceptance to create a conceptual solution comprised of preferred fulfillment methods. Additionally, the Company may issue an RFP to assess market viability of available resources and program participation. In the event existing programs and available resources do not fulfill the identified needs, opportunities to develop other programs[7] could emerge. Prior to this filing, the Company confirmed with developers and organizations, such as DR Horton and Hawaii Energy, an acknowledgment to collaborate on and explore NWA offerings.

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[7] In the context of aggregators, the program would consist of specification of the necessary delivery requirements.

4. **Recommend solutions.** The recommended solution would be the result of the evaluation process described in step 3. The solution may be a single offering or a portfolio consisting of a combination of existing and new resources and programs. An application for approval of resource procurement and/or new program development will be submitted if deemed part of the recommended solution.

If this initiative proves successful, the Company hopes to use this process as a template for development of future NWA partnerships and opportunities.

Workplan Schedule

In response to the new developments and anticipated load growth in East Kapolei, the work plan is targeted for completion in early 2022. This will ensure resources are available for operation by 2026 to align with projected grid needs to mitigate overload conditions identified during Soft Launch. If load growth in the area takes a different trajectory as a result of the grid needs reassessment, the workplan would be modified accordingly.

The estimated schedule for the work plan is:

Work Plan Step	Completion Date
Assess Needs	August 2020
Identify Options	November 2020
Evaluate Options	March 2021
Conduct RFPs (If Necessary)	December 2021
Finalize Pilot Program	February 2022
Recommend Solutions	March 2022
Submit Application	March 2022
Start Implementation	January 2024

Sedway Consulting, Inc.

INDEPENDENT OBSERVER REPORT FOR HAWAIIAN ELECTRIC'S 2019 REQUEST FOR PROPOSALS FOR NON-WIRES ALTERNATIVES TO PROVIDE RELIABILITY (BACK-TIE) SERVICES FOR THE EAST KAPOLEI AREA

Submitted by:

Alan S. Taylor
Sedway Consulting, Inc.
Boulder, Colorado

May 19, 2020

TABLE OF CONTENTS

Introduction and Background

On November 8, 2019, Hawaiian Electric Company, Inc. (Hawaiian Electric) issued its 2019 Request for Proposals for Non-Wires Alternatives (NWAs) to Provide Reliability (back-tie) Services for the East Kapolei Area (IGP Soft Launch). In accordance with the State of Hawaiʻi Public Utilities Commission (PUC) Order 36218 issued on March 14, 2019 (Accepting the IGP Workplan and Providing Guidance) as part of Docket No. 2018-0165, the purposes of the IGP Soft Launch were to:

1) Solicit NWAs for the East Kapolei area to defer wires investments at the Hoʻopili Substation and Kapolei 4 Circuit by mitigating normal overloads and providing reliability (back-tie) services, and

2) Demonstrate the sourcing processes and evaluation methods for distribution NWAs with the goal of informing development of the full scale IGP planning and sourcing effort.

Hawaiian Electric's IGP Soft Launch sought NWAs to meet the following requirements to defer distribution investments at two locations:

<u>Kapolei 4 Circuit Extension Deferral Opportunity</u>

> 3.5 MW of reliability (back-tie) services at the Kapolei 2 transformer needed January through December with delivery hours of 5pm-11pm starting February, 2022 and needed a maximum number of 365 days per year.

<u>Hoʻopili Substation Deferral Opportunity</u>

a) Needed distribution capacity of:

   i) 4.7 MW at the Kaloi 1 transformer available January through December with delivery hours from 1pm-11pm starting January, 2023 and needed a maximum number of 365 days per year, and

   ii) 0.3 MW at the Kaloi 3 circuit available August through October from 7pm-9pm starting August, 2023 and needed a maximum number of 69 days per year.

b) Needed reliability (back-tie) services needed January through December of:

   i) 3.5 MW at the Kapolei 2 transformer with delivery hours of 5pm-11pm starting February, 2022 and needed a maximum number of 365 days per year;

ii) 5.1 MW at the Ewa Nui 2 circuit with delivery hours of 11am-12am (i.e., 13-hour duration) starting January, 2023 and needed a maximum number of 365 days per year;

iii) 9.7 MW at the Kaloi 1 transformer with delivery hours of 6am-8am and 9am-12am (i.e., 17-hour duration) starting January, 2023 and needed a maximum number of 365 days per year;

iv) 2.6 MW at the Kaloi 3 circuit with delivery hours of 5pm-11pm starting January, 2023 and needed a maximum number of 365 days per year; and

v) 1.0 MW at the Kamokila 4 circuit with delivery hours of 5pm-10pm starting May, 2023 and needed a maximum number of 226 days per year.

Both deferral opportunities assumed that the distribution investments could be deferred up to 5 years.

For the Ho‘opili Substation, the Distribution Capacity needs at the Kaloi 1 transformer and Kaloi 3 circuit could both be met by meeting the reliability needs at those two locations. For example, a 9.7 MW NWA at the Kaloi 1 transformer would meet both the distribution capacity and reliability needs for that location. Similarly, a 2.6 MW NWA at the Kaloi 3 circuit would also meet both the distribution capacity and reliability needs for the Kaloi 3 circuit.

In addition, an NWA at one location had the potential to reduce the need at other locations. For instance, a solution at the Ewa Nui 2 circuit had the potential of reducing a portion of the needs at the Kaloi 1 transformer, Kaloi 3 circuit, and Kamokila 4 circuit.

Bidders were allowed to provide Behind the Meter (BTM) or In-Front of the Meter (IFTM) proposals in 50 kW increments and 2-hour increments up to the RFP needs. Therefore, the RFP sought proposals that either (a) met the entire need on their own, or (b) met a portion of the need where they might be combined with other “partial” proposals into cost-effective portfolios that would defer the distribution system improvements.

Any new solution or “add on” to an existing solution could be eligible in the RFP, regardless of technology type, as long as it met the following requirements:

- the solution could not be paid more than once for services it already provided to the grid and already accounted for in load and DER forecasts (i.e., no double counting),
- repurposed solutions must not adversely affect the grid, meaning that if the solution was called for one service, it must still be available to meet other requirements for which it was contracted or paid,

- the project could not be a utility-scale generation project currently under contract, including those under the feed-in tariff, and
- bidders of energy efficiency projects could not receive rebates as participants in this RFP.

Table 1 lists the schedule followed in the RFP:

Table 1
Hawaiian Electric IGP Soft Launch RFP Schedule

RFP issued	November 8, 2019
Prerecorded webinar conference	November 15, 2019[1]
Proposal due date	January 7, 2020
Deadline for IO to receive proposal files	January 8, 2020
Debriefing sessions	Early March

Role of the Independent Observer

The role of the Independent Observer (IO) in the IGP Soft Launch is adapted from PUC Order 23121 approving the IGP Workplan which stipulates when an IO is required and the IO's obligations. In November 2019, in compliance with this order and in coordination with the IGP Distribution Planning Working Group, Hawaiian Electric retained Sedway Consulting, Inc. (Sedway Consulting) as an IO to monitor Hawaiian Electric's IGP Soft Launch RFP. Sedway Consulting has served as an independent observer/evaluator in numerous utility distribution deferral solicitations in recent years, evaluating NWA offers for over two dozen project locations. Thus, Sedway Consulting was in a position to provide insights from these other project experiences to help Hawaiian Electric's IGP Soft Launch RFP be as successful as possible and/or yield possible suggestions for improvements in future NWA RFPs.

As described on Page 12 of the RFP, the role of the IO is to monitor all steps in the solicitation process and ensure that the RFP is undertaken in a fair and unbiased manner. Sedway Consulting was provided access to all appropriate materials. Sedway Consulting reviewed Hawaiian Electric's RFP documents, outreach efforts, evaluation processes, modeling methodologies, communications with bidders, and evaluation and selection results.

Members of the IO team:

[1] The actual date that the pre-recorded webinar was provided on Hawaiian Electric's IGP website was delayed by a few days due to technical difficulties.

- reviewed the RFP documents prior to their issuance.
- listened to Hawaiian Electric's Prerecorded Webinar Conference,
- reviewed email exchanges between potential Proposers and Hawaiian Electric,
- discussed evaluation methods and processes with Hawaiian Electric,
- anchored all evaluation assumptions prior to the receipt of proposals,
- reviewed estimated deferral values for the targeted distribution system upgrades,
- received all bid information directly from Proposers,[2]
- performed an independent review and evaluation of proposals,
- conferred with Hawaiian Electric on the evaluation results,
- coordinated with Hawaiian Electric on approaching Proposers for debriefing sessions about the RFP,
- coordinated with PUC staff on monitoring results and providing necessary details during each stage of the RFP,
- by way of this report, provided an overall assessment of the RFP, and
- participated in all debriefing and IGP Working Group calls in which the RFP process was discussed, and feedback was solicited.

Pre-Proposal-Submission: IO Findings and Recommendations

Sedway Consulting believes that Hawaiian Electric pursued reasonable and adequate procedures for notifying potential interested parties. Specifically, Hawaiian Electric dedicated a section of its company website to the solicitation, providing a means for interested parties to download the RFP instructions and related materials. On the RFP launch date of November 8, 2019, Hawaiian Electric notified approximately 180 market participants via Hawaiian Electric's email distribution list (compiled from previous power supply solicitations, regulatory service lists, etc.) that the RFP had been released and invited them to participate.

Within the set of RFP documents that were issued, Hawaiian Electric provided an Excel workbook where bidders with BTM resources could input the size and prices for their proposals directly by requirement, month, and customer type. Input prices included Management prices in $/kW-mo, enablement prices in $/kW, and incentive prices in $/kW-mo. The workbook also included an incentive adder of $2/kW-mo.

[2] Bidders were instructed to provide physical delivery of a USB thumb drive with their offer materials to Sedway Consulting for receipt no later than one business day following the deadline for uploading such materials to Hawaiian Electric's web-platform. This ensured that the IO had materials directly from each bidder and allowed Sedway Consulting to ensure that what had been uploaded to Hawaiian Electric was indeed what each bidder had intended to submit.

For IFTM proposals, there was no Excel workbook for proposal submission. Instead, Hawaiian Electric provided a Proposal Summary Table (in the RFP's Appendix B, pages B-5 through B-6) which included a list of information needed for the proposal. This list included lump-sum pricing information in $/year and capacity and energy offered.

IO Recommendation #1: IFTM offer workbook. For consistency sake in future NWA RFPs, Sedway Consulting encourages Hawaiian Electric to consider providing a spreadsheet pricing and operating parameters template for IFTM resources too. It has been a general practice in other utility solicitations that Sedway Consulting has overseen that the RFP documents include spreadsheet pricing templates for whatever product types are being solicited. This helps avoid bidder confusion and potential inconsistencies in data submission.

Hawaiian Electric requested bidders to provide $/year, $/kW, and/or $/kW-month fixed pricing. Many NWA products have variable costs (i.e., $/MWh expenses associated with actual delivered energy or load reduction). Because of this, in other NWA solicitations, Sedway Consulting has seen utilities allow for both fixed and variable pricing for offers. This allows a bidder to propose fixed charges that are based on their project development and installation costs and variable charges that reflect costs associated with each dispatch request (e.g., energy charging costs or degradation effects for battery systems). Relying only on a fixed charge structure forces a bidder to assume the highest-use scenario (i.e., maximum number of calls/year) and price all of the variable costs of that scenario into its proposed fixed charge. If indeed the utility truly expects to call on the NWA product for the maximum number of dispatches in each year of the contract, there is no need to bifurcate charges into fixed and variable components. However, if there is a chance that lower-use scenarios may arise, a contract structure with a variable price component will yield savings for utility customers.

IO Recommendation #2: Variable Pricing. Sedway Consulting recommends that Hawaiian Electric consider adding a $/MWh variable cost component to its NWA offer/contract structure in future NWA RFPs.

Receipt and Evaluation of Proposals

On January 7, 2020, Hawaiian Electric received proposals through the Power Advocate platform, with Sedway Consulting receiving proposals directly via flash-drive a day after that deadline, as requested in the RFP instructions.

Both Hawaiian Electric and Sedway Consulting performed parallel Initial Evaluations[3] and determined that the proposals received did not include enough capacity to meet either the Kapolei 4 circuit extension or Hoʻopili Substation needs.

Sedway Consulting reviewed and discussed the proposals with Hawaiian Electric and agreed that there was insufficient capacity (by a large margin) to justify continuing with the RFP process. Details of the proposal information are not public, but this report includes a confidential appendix that provides proposal pricing, quantity, and seller identity information.

Sedway Consulting participated in discussions with Hawaiian Electric (and later with the Distribution Planning Working Group participants and the PUC) that culminated with Hawaiian Electric's formal decision not to shortlist any proposals. Debriefing calls to solicit feedback from bidders and other stakeholders were pursued. Sedway Consulting encouraged Hawaiian Electric to cast as wide a net as possible, emailing its request for feedback from everyone on the original RFP launch email distribution list (and not just those entities that had registered on PowerAdvocate).

Sedway Consulting concluded that Hawaiian Electric administered its evaluation and selection process fairly. The fact that Sedway Consulting conducted a parallel, independent bid receipt and evaluation process allowed it to confirm Hawaiian Electric's results and verify that there was an insufficient response that did not yield enough offered capacity to address either the Kapolei 4 Circuit Extension or the Hoʻopili Substation needs. Sedway Consulting concurred with Hawaiian Electric's final decision to discontinue the RFP efforts and move ahead with the distribution system investment projects.

Post-Proposal-Submission: IO Findings and Recommendations

Sedway Consulting concluded that Hawaiian Electric's evaluation design and administration was unbiased and fair. The process was designed to treat all bidders fairly, employing a consistent methodology that did not favor or disadvantage any bidder or product.

[3] Hawaiian Electric's RFP included procedures for completing an Initial Evaluation and a subsequent Detailed Evaluation. Since the Initial Evaluation determined that not enough capacity was proposed to meet the RFP requirements to defer either the Kapolei 4 Circuit Extension or the Hoʻopili Substation upgrades, the Detailed Evaluation stage proved to be unnecessary.

Sedway Consulting was copied on all email communications with bidders and ensured that consistent information was being provided to all. Sedway Consulting participated in all debriefing calls and concluded that Hawaiian Electric treated all participants consistently and fairly.

Given Sedway Consulting's activities with this RFP, the information the IO received from the debriefing calls, and insights from its experience in other utility NWA RFPs, Sedway Consulting offers up the following recommendations for potential improvements for Hawaiian Electric's future NWA RFPs:

IO Recommendation #3: Timing of offer submission. If possible, it could be beneficial if the schedule for the annual IGP process was adjusted to accelerate the launch of the RFP and make the proposal submission deadline in early or mid-November, before the holidays.

As seen in Table 1, Hawaiian Electric issued the IGP Soft Launch RFP on November 8, 2019 with a proposal due date of January 7, 2020. Thus, bidders had to perform their research and prepare their proposals over the end-of-year holiday period – a time of year when many firms ramp down as many employees leave for Thanksgiving and December holiday breaks. This timing may have made it hard for some bidders to compile and submit proposals. Sedway Consulting understands that Hawaiian Electric's IGP process involves several stages, internal departments, and stakeholders, so it may be difficult to move the due date of future IGP solicitations. However, if possible, moving the proposal submission date away from the holiday period may help increase participation and the likelihood that sufficient cost-effective NWA capacity is offered.

IO Recommendation #4: Refinement of screening criteria for deferral opportunities. Identifying upcoming distribution system upgrades that may be appropriate candidates for deferral with NWA resources is a challenging process, but Hawaiian Electric may want to focus on those with shorter need durations (i.e., the span of hours per day) and fewer calls per year.

The NWA needs in Hawaiian Electric's IGP Soft Launch RFP were for fairly long durations – as long as 17 hours per day for the Kaloi 1 transformer need of the Hoʻopili substation. In addition, for both Hoʻopili and Kapolei 4, most of the needs were for 365 days per year. In Sedway Consulting's experience, it is difficult for NWA resources to cost-effectively provide generation or load reductions for such long daily periods and for every day of the year. For future NWA RFPs, Hawaiian Electric may want to focus on locations where the need durations are shorter and the call frequencies are less.

IO Recommendation #5: Longer deferral period. Hawaiian Electric's IGP Soft Launch RFP sought NWAs that could defer distribution system investments up to five years. Longer deferral periods (i.e., with the investments pushed out further) naturally result in greater deferral savings. And given longer contract periods over which to recover development and project capital costs, NWA bidders can often provide lower

$/kW-month prices. Although Sedway Consulting recognizes that there are challenges (e.g., localized load forecasting uncertainty) associated with longer deferral periods, the IO recommends that Hawaiian Electric give some consideration in future NWA RFPs to identifying distribution system upgrade projects where longer deferral periods may be applicable. For example, in other utility NWA RFPs, Sedway Consulting has seen deferral periods of seven years.

IO Recommendation #6: Simplification of RFP document(s). Sedway Consulting found Hawaiian Electric's RFP materials to be quite comprehensive. However, sometimes less is more, and Sedway Consulting recommends that Hawaiian Electric explore ways to reduce and streamline its RFP documents. If solicitation materials are too voluminous and exhaustive, they may deter bidder participation because there is too much for bidders to digest and ensure their proposals will be compliant with all RFP requirements. Particularly because NWA RFPs tend to be for fairly small amounts of capacity (and thus for modest total contract costs), it is important to keep the administrative and proposal preparation efforts as light as possible.

In other NWA RFPs that Sedway Consulting has overseen (and which have successfully resulted in the procurement of NWAs), the main RFP document has been a couple dozen pages, with less than a half dozen supplemental documents (e.g., offer pricing spreadsheet, load forecast and customer data, confidentiality agreement, etc.)

Again, Sedway Consulting recognizes the benefits of the comprehensiveness and transparency of the IGP Soft Launch RFP materials that were provided to potential bidders. However, it is important to strike a balance between too little and too much, and Sedway Consulting believes that Hawaiian Electric's RFP would benefit from some simplification and streamlining.

IO Recommendation #7: Redlined power purchase agreement (PPA). Hawaiian Electric's IGP Soft Launch RFP required bidders to review a full pro forma contract and submit a redlined version that displayed what they would seek to revise if shortlisted. While there are some benefits for the utility and IO evaluation teams to having such a redline provided at the outset, it is a significant undertaking and legal expense for a bidder that may discourage participation in the RFP. Sedway Consulting recommends that Hawaiian Electric consider issuing a simplified term sheet with future RFPs and require bidders to redline or comment on that document, with formal redlining of a full contract being required if and only if a bidder is selected to the Priority List (i.e., shortlisted). A redlined term sheet could save bidders significant time and money while identifying most areas where changes to the contract would impact the proposal evaluation. The full contract redline requirement at shortlisting is a procedure that Sedway Consulting has seen adopted successfully by other utilities.

IO Recommendation #8: Other services. Often NWA products can provide other services – beyond the specific distribution capacity or reliability back-tie services – that may be beneficial to Hawaiian Electric. Sedway Consulting recommends that Hawaiian

Electric consider procuring and valuing these other services. Sedway Consulting has seen some utilities focus only on procuring the distribution service product in their NWA RFPs while others have been open to procuring system capacity, energy, and ancillary service products, if available, from NWA projects. In the latter instance, this relieves the NWA bidder from having to monetize these benefits themselves. In the former case, NWA bidders are expected to minimize their distribution capacity prices after identifying other potential revenue streams from other off takers. However, given that there are no other offtakes in Hawaiian Electric's service territory, this is not possible. In any case, the idea of multi-product procurement deserves some more thought.

IO Recommendation #9: Exporting energy from BTM resources. For BTM resources, the question of whether a storage or generation source can output more than on-site customer load (and thus export to the grid at times) is a complicated one and often depends on a utility's tariffs and/or interconnection requirements. It is not always easy for a BTM bidder to navigate these tariffs/requirements. Sedway Consulting notes that Hawaiian Electric provided significant detail regarding allowable exports in the RFP's Appendix I but, in future RFPs, encourages Hawaiian Electric to either move this information into the main RFP document and/or highlight it in the bidder webinar presentation.

Overall, Sedway Consulting believes that Hawaiian Electric did a good job in designing and administering its 2019 IGP Soft Launch RFP. The above IO recommendations are fairly minor and are merely suggestions for potential improvements and lessons learned for future NWA RFPs.

Conclusion

Sedway Consulting believes that Hawaiian Electric conducted a fair solicitation and evaluation of the proposals received in response to its 2019 IGP Soft Launch RFP.

Sedway Consulting was provided access to all necessary materials and was able to parallel Hawaiian Electric's process with its own evaluation of the proposals. Sedway Consulting conferred with Hawaiian Electric on the results and agreed with the decision not to shortlist any counterparties.

Sedway Consulting monitored the back-and-forth email traffic between Hawaiian Electric and all counterparties and believes that Hawaiian Electric treated everyone consistently and fairly. Sedway Consulting concludes that Hawaiian Electric made appropriate and fair decisions in its IGP Soft Launch RFP.

Appendix A
HECO 2019 IGP Soft Launch RFP
Evaluation Results

Solicitation Response

In its 2019 IGP Soft Launch RFP, HECO (and Sedway Consulting) received [redacted] NWA proposals from [redacted]. [redacted] proposals included [redacted] [redacted] for the Ho'opili Substation and [redacted] for the Kapolei 4 Circuit Extension. The proposals are summarized in Tables A-1 and A-2, where each location's distribution project needs are summarized as well to provide context.

Table A-1
HECO 2019 IGP Soft Launch RFP
[redacted] Ho'opili NWA Proposal

Reliability Needs*

Need	MW	COD	Months	# Hours	# Days
Ewa Nui Ckt	5.1	1/1/2023	Jan-Dec	13	365
Kaloi 1 Tsf	9.7	1/1/2023	Jan-Dec	17	365
Kaloi 3 Ckt	2.6	1/1/2023	Jan-Dec	6	365
Kamokili 4 Ckt	1	5/1/2023	Jan-Dec	5	226

[redacted]

Proposal	MW	COD	Months	# Hours	# Days	Management Fee ($/kw-mo)	Enablement Fee ($/kw)
[redacted]							

* Ho'opili also has capacity needs but the capacity needs are met as long as reliability needs are met.

Table A-2
HECO IGP Soft Launch RFP
[redacted] Kapolei 4 NWA Proposal

Reliability Needs

Need	MW	COD	Months	# Hours	# Days
Kapolei 4	3.5	2/1/2022	Jan-Dec	6	365

[redacted]

Proposal	MW	COD	Months	# Hours	# Days	Management Fee ($/kw-mo)	Enablement Fee ($/kw)
[redacted]							

Offer Evaluation

Neither of the [redacted] proposals from [redacted] was large enough (or provided enough hours per day) to address the Ho'opili Substation or Kapolei 4 needs. [redacted] proposal that would apply to Ho'opili would meet about [redacted] of the total capacity needed to defer the substation upgrades (and for [redacted] only). [redacted] proposal that would apply to Kapolei 4 would meet about [redacted] of the total capacity needed to defer the circuit extension upgrades (again, only for [redacted] of the 6-hour duration).[1]

Sedway Consulting concluded that doing significant additional evaluation was unnecessary as [redacted] offers were only a small fraction of the need. Thus, it would be extremely unlikely that [redacted] would be able to "scale-up" its proposals to meet the entire need at either area.

Nevertheless, Sedway Consulting did complete a theoretical exercise that looked at whether [redacted] proposal would have been cost-effective on a scaled basis. Sedway Consulting

[1] As an aside, Sedway Consulting learned in subsequent discussions with HECO [redacted] that the bidder had submitted the same offers in response to another earlier HECO RFP. Thus, there did not appear to be much effort undertaken by the bidder to customize its offers to the IGP RFP needs.

completed this by calculating the present value of the costs of the proposal and comparing it to apportioned deferral values to match with the sizes and hours duration that [redacted] proposed for each location/area. Since HECO's published deferral values applied to greater, multiple needs and duration hours, Sedway Consulting calculated the apportioned deferral values using the following formula:

$$Apportioned\ Deferral\ Value = Deferral\ Value * \frac{(proposal\ MW * proposal\ duration\ hours)}{\sum_{Need\ A}^{Need\ D}[(need\ MW) * (need\ duration\ hours)]}$$

Table A-3 shows each proposal's costs, the apportioned deferral values, and the net present values (NPV) of each proposal's combined costs and benefits. The table shows that [redacted] proposals cost many multiples more than their apportioned deferral values and it is unlikely that they would have been cost-effective even if somehow scaled up or combined with other similar theoretical (i.e., non-existent) proposals.

Table A-3
HECO IGP Soft Launch RFP
Scaled Evaluation [redacted]
(present value $000)

Need	Proposal Costs*	Deferral Value	Apportioned Deferral Value	NPV
Ho'opili	[redacted]			
Kapolei				

* Proposal costs include revenue taxes; imputed debt was not included (as it was not intended to be a part of the initial evaluation, only the later detailed evaluation if the process got that far).

Sedway Consulting concluded that HECO's 2019 IGP Soft Launch RFP resulted in several lessons learned (as discussed in the main public report) but that there were no NWA proposals worthy of shortlisting.

Hawaiian Electric
Maui Electric
Hawai‘i Electric Light

Project Justification with Business Case Support for the Kulanihakoi Substation Project

DATE	PROJECT NAME
10/23/2020	Kulanihakoi Substation Project
PREPARER	
Project Management & Distribution Planning	

Note: References to exhibit numbers in this document refer to exhibits included in the accompanying Application.

EXECUTIVE SUMMARY

Hawaiian Electric Company, Inc. (“Hawaiian Electric” or the “Company”) forecasts significant load growth in the Ho‘opili area of west O‘ahu from 2019 to 2030. Hawaiian Electric’s existing distribution system has insufficient capacity to serve near-term electrical loads. Current estimates indicate that loads are projected to increase significantly, by over 52.8 MVA by 2023, causing numerous equipment overloads under normal and contingency conditions. Increasing overloads under both normal and contingency conditions are forecasted beyond 2023 as loads increase. By 2030, the forecasted load growth in the area is estimated to increase by 81.4 MVA, the majority of which is associated with the new Ho‘opili subdivision.

Both traditional wires solutions and Non-Wires Alternatives (“NWA”s) were identified and evaluated. The option to develop a new system substation (Kulanihakoi Substation; formerly known as Ho‘opili Substation) within the Ho‘opili development was recommended to allow for the timely installation of critical infrastructure to the electrical system. Kulanihakoi Substation will provide necessary capacity to serve projected loads and provide essential reliable power under normal and contingency conditions.

In 2019, Hawaiian Electric issued a Request for Proposal (“RFP”) seeking potential NWA solutions to defer the distribution investment needed to mitigate the projected overloads in the Ho‘opili area as part of the Company’s Integrated Grid Planning (“IGP”) Soft Launch. Hawaiian Electric announced on February 13, 2020 that it would not move forward with the IGP Soft Launch RFP because the proposals submitted did not meet the specified performance and operational requirements. As a result, Hawaiian Electric is moving forward with an application for the Kulanihakoi Substation.

The proposed Kulanihakoi Substation Project will initially install one 46-12 kV, 10/12.5 MVA distribution transformer, two 46 kV circuits, and two 12 kV circuits, with provisions for three additional 46-12 kV, 10/12.5 MVA distribution transformers. The project is scheduled to commence construction in December 2021 with an in-service date of November 2022, at a total estimated capital cost of $15.9 million.

Hawaiian Electric respectfully submits that the proposed Kulanihakoi Substation Project is reasonable and in the public interest, and should be approved, as the Project was selected through a Commission-approved process that has resulted in the lowest cost to customers for a required resource.

BUSINESS CASE

A. Background

In March 2006, D.R. Horton acquired approximately 1,550 acres of former sugar cane lands in west Oʻahu from the James Campbell Estate. In May 2015, the Honolulu City Council approved the development of the Hoʻopili subdivision (the "Project"). The Project broke ground in September 2016 with some homes already constructed. The entire Project will be built out in 19 phases ending in 2030. The total electrical demand for the Project is over 61 MVA. The Project load is expected to increase every year from 2018 to 2030, with the largest increases in load additions forecasted to occur between 2021 and 2023.

In addition to the Hoʻopili project, there are also over 20 other future projects planned for completion in the next few years in the area. The load for these projects total approximately 25 MVA of new load growth.

B. Hoʻopili Area Study and Addendum

An equipment loading analysis was performed to determine if the existing electrical infrastructure has adequate distribution and subtransmission capacity to serve the projected load growth of the Kapolei and Hoʻopili area. The study identified the location, magnitude, duration, and frequency of planning criteria violations for every year from 2019 to 2030. Based on the latest energization schedule provided by D.R. Horton which is utilized in the updated analysis in the Addendum to the study, overloads due to normal and contingency conditions are forecasted to occur beginning January 2023. Increasing overloads under normal and contingency conditions are forecasted beyond 2023 as loads increase.

Three traditional wires options were identified and evaluated to alleviate the overload conditions and to provide adequate capacity for future loads. These options include the following:

- <u>Option 1</u>: Develop a new system substation (Kulanihakoi Substation; f.k.a. Hoʻopili Substation) within the Hoʻopili development with provisions for four 46-12 kV, 10/12.5 MVA distribution transformers. Initially, install one 46-12 kV, 10/12.5 MVA distribution transformer, two 46 kV circuits, and two 12 kV circuits.
- <u>Option 2</u>: Install one additional 46-12 kV, 10/12.5 MVA distribution transformer at the existing Kaloi substation, one additional 46 kV circuit, and two 12 kV circuits.

- Option 3: Install one additional 46-12 kV, 10/12.5 MVA distribution transformer at the existing Ewa Nui substation, one additional 138-46 kV, 48/80 MVA subtransmission transformer, and two 12 kV circuits.

Based on the analysis of all the options, Option 1 is the recommended solution for the following reasons:

- It resolves all distribution transformer and circuit normal and contingency conditions.
- It increases distributed energy resource ("DER") hosting capacity in the East Kapolei area.
- It provides initial capacity to serve the Hoʻopili area until future transformer capacity or NWAs are required for the area.
- It would be located near the load center, minimizing costs to install distribution circuits.
- It would be located near 46-kV circuits, minimizing costs to install subtransmission circuits.
- It is the most cost-effective option.

The proposed project will allow for the timely installation of critical infrastructure to the electrical system, which will provide necessary capacity to serve projected loads and provide essential reliable power under contingency conditions.

C. Request for Proposals for NWAs

NWAs for this area were assessed as part of the IGP process Soft Launch. On November 8, 2019, Hawaiian Electric issued a RFP for NWAs to provide Reliability (back-tie) Services for the East Kapolei Area. In accordance with Commission Order 36218 issued on March 14, 2019 (Accepting the IGP Workplan and Providing Guidance) as part of Docket No. 2018-0165, the purposes of the IGP Soft Launch were to:

1. Solicit NWAs for the East Kapolei area to defer wires investments at the Hoʻopili Substation and Kapolei 4 Circuit by mitigating normal overloads and providing reliability (back-tie) services, and
2. Demonstrate the sourcing processes and evaluation methods for distribution NWAs with the goal of informing development of the full scale IGP planning and sourcing effort.

Hawaiian Electric's IGP Soft Launch sought NWAs to meet the following requirements to defer distribution investments at two locations:

1. Kapolei 4 Circuit Extension Deferral Opportunity
2. Hoʻopili Substation Deferral Opportunity

Proposals were received on January 7, 2020. Both Hawaiian Electric and an Independent Observer ("IO") performed parallel Initial Evaluations and determined that the proposals received did not include enough capacity to meet either the Kapolei 4 circuit extension or Ho‘opili Substation needs.

The IO reviewed and discussed the proposals with Hawaiian Electric and agreed that there was insufficient capacity (by a large margin) to justify continuing with the RFP process. In consultation with the IO, Hawaiian Electric announced on February 13, 2020 that it would not move forward with the IGP Soft Launch RFP because the proposals submitted did not meet the specified performance and operational requirements. As a result, Hawaiian Electric is moving forward with an application for the Kulanihakoi Substation.

The IO concluded that Hawaiian Electric administered its evaluation and selection process fairly and concurred with Hawaiian Electric's final decision to discontinue the RFP efforts and move ahead with the distribution system investment projects.

D. Kulanihakoi Substation is Lowest Cost Option to Customers

The results of the 2019 RFPs for NWAs indicated that the proposals submitted did not meet the specified performance and operational requirements. As a result, Hawaiian Electric is moving forward with an application for the Kulanihakoi Substation. Specifically:

1. Capital Cost: As detailed in Exhibit 6, the total estimated capital cost for the Kulanihakoi Substation Project is $15.9 million.
2. O&M: The Company is not seeking recovery of Project O&M costs through MPIR mechanism.
3. Revenue Requirements: The resultant revenue requirements for the Project are detailed in Exhibit 7.
4. Net Costs: Under the MPIR Guidelines, any cost savings that would be realized due to the Project's implementation should be returned to customers. There are no cost savings attributed to this Project..

SUMMARY

The proposed Kulanihakoi Substation Project provides customers with the lowest cost, most feasible option available, and should be approved on this basis.

The purpose of this Schedule B1 is to illustrate how the Kulanihakoi Substation project will flow through the MPIR mechanism into Target Revenue. All other numbers are from Transmittal No. 20-01 Consolidated (Decoupling) filing filed on June 5, 2020 and will change.

SCHEDULE B1
(To file by Dec 2022 for Yr 1)
(To file by Feb 2023 for Yr 2)
PAGE 1 OF 1

HAWAIIAN ELECTRIC COMPANY, INC.
DECOUPLING CALCULATION WORKBOOK
DETERMINATION OF TARGET REVENUES

Line No.	Description	Reference		Docket No. 2016-0328 Amounts	Docket No. 2016-0328 Amounts	Docket No. 2016-0328 Amounts	Docket No. 2016-0328 Amounts	Docket No. 2016-0328 Amounts	Note (6) MPIR Illustration Effective 12/1/2022	Note (6a) MPIR Illustration Effective 1/1/2023
	(a)	(b)		(c)	(d)	(e)	(f)	(g)	(h)	(i)
1	Last Rate Case Annual Electric Revenue at Approved Rate Leve	Note (2), (2a)	$000s	$ 1,529,709	$ 1,529,709	1,529,709	$ 1,529,709	$ 1,529,709	$ 1,529,709	$ 1,529,709
2	Less: Fuel Expense	Note (2)	$000s	$ (327,609)	$ (327,609)	(327,609)	$ (327,609)	$ (327,609)	$ (327,609)	$ (327,609)
3	Purchased Power Expense	Note (2)	$000s	$ (466,211)	$ (466,211)	(466,211)	$ (466,211)	$ (466,211)	$ (466,211)	$ (466,211)
4	Revenue Taxes on Line 1 (8.885% statutory rates)		$000s	$ (135,915)	$ (135,915)	(135,915)	$ (135,915)	$ (135,915)	$ (135,915)	$ (135,915)
5	Last Rate Order Target Annual Revenues	Sum Lines 1...4	$000s	$ 599,974	$ 599,974	599,974	$ 599,974	$ 599,974	$ 599,974	$ 599,974
6	Authorized RAM Revenues	Note (3)	$000s	$ 13,828	$ -	-	$ -	$ -	$ -	$ -
7	Less: Revenue Taxes on Line 6 at 8.885%		$000s	$ (1,229)	$ -	-	$ -	$ -	$ -	$ -
8	Net RAM Adjustment - Test Year +1	Lines 6 + 7	$000s	$ 12,599	$ -	-	$ -	$ -	$ -	$ -
9	Authorized RAM Revenues	Note (4)	$000s	$ -	$ 20,351	20,351	$ -	$ -	$ -	$ -
10	Less: Revenue Taxes on Line 9 at 8.885%		$000s	$ -	$ (1,808)	(1,808)	$ -	$ -	$ -	$ -
11	Net RAM Adjustment - Test Year +2	Lines 9 + 10	$000s	$ -	$ 18,543	18,543	$ -	$ -	$ -	$ -
12	Authorized RAM Revenues	Sch A	$000s	$ -	$ -	-	$ 40,988	$ 40,988	$ 40,988	$ 40,988
13	Less: Revenue Taxes on Line 12 at 8.885%		$000s	$ -	$ -	-	$ (3,642)	$ (3,642)	$ (3,642)	$ (3,642)
14	Net RAM Adjustment - Test Year +3	Lines 12 + 13	$000s	$ -	$ -	-	$ 37,346	$ 37,346	$ 37,346	$ 37,346
15	Authorized MPIR Revenues	Sch L, La, Note (5)	$000s	$ 19,811	$ 19,811	$ 23,448	$ 23,448	$ 23,448	$ 24,252	$ 25,449
16	Less: Revenue Taxes on Line 15 at 8.885%		$000s	$ (1,760)	$ (1,760)	(2,083)	$ (2,083)	$ (2,083)	$ (2,155)	$ (2,261)
17	Net MPIR Adjustment	Lines 15 + 16	$000s	$ 18,051	$ 18,051	21,365	$ 21,365	$ 21,365	$ 22,097	$ 23,188
18	Less: EARNINGS SHARING REVENUE CREDITS	Sch A	$000s	$ -	$ -	-	$ -	$ -	$ -	$ -
19	Less: Revenue Taxes on Line 18 at 8.885%		$000s	$ -	$ -	-	$ -	$ -	$ -	$ -
20	Net Earnings Sharing Revenue Credits	Lines 18 + 19	$000s	$ -	$ -	-	$ -	$ -	$ -	$ -
21	Less: PERFORMANCE INCENTIVE MECHANISM	Sch A, Note (4)	$000s	$ -	$ (1,269)	(1,269)	$ 923	$ 923	$ 923	$ 923
22	Less: Revenue Taxes on Line 21 at 8.885%		$000s	$ -	$ 113	113	$ (82)	$ (82)	$ (82)	$ (82)
23	Net Performance Incentive Mechanism	Lines 21 + 22	$000s	$ -	$ (1,157)	(1,157)	$ 841	$ 841	$ 841	$ 841
24	Less: 2017 TEST YEAR FINAL D&O REFUND	Note (4)	$000s	$ -	$ (48)	(48)	$ -	$ -	$ -	$ -
25	Less: Revenue Taxes on Line 24 at 8.885%		$000s	$ -	$ 4	4	$ -	$ -	$ -	$ -
26	Net 2017 Test Year Final D&O Refund	Lines 24 + 25	$000s	$ -	$ (44)	(44)	$ -	$ -	$ -	$ -
27	Less: AFFILIATE TRANSACTION REFUND	Sch A	$000s	$ -	$ -	-	$ (43)	$ (43)	$ (43)	$ (43)
28	Less: Revenue Taxes on Line 27 at 8.885%		$000s	$ -	$ -	-	$ 4	$ 4	$ 4	$ 4
29	Net Affiliate Transaction Refund	Lines 27 + 28	$000s	$ -	$ -	-	$ (39)	$ (39)	$ (39)	$ (39)
30	Add: OBF PROGRAM IMPLEMENTATION COSTS	Sch A, Line 1a * 1.0975	$000s	$ -	$ 844	844	$ 854	$ 854	$ 854	$ 854
31	Less: Revenue Taxes on Line 30 at 8.885%		$000s	$ -	$ (75)	(75)	$ (76)	$ (76)	$ (76)	$ (76)
32	Net OBF Program Implementation Costs	Lines 30 + 31	$000s	$ -	$ 769	769	$ 779	$ 779	$ 779	$ 779
33	Less: PUC-ORDERED MAJOR OR BASELINE CAPITAL CREDITS:	Note (4)	$000s	$ -	$ -	-	$ -	$ -	$ -	$ -
34	Total Annual Target Revenues									
35	June 1, 2018 Annualized Revenues w/RAM Increase & MPIR accrued 1/1/19	Col (c), lines (5+8+17+20+33)	$000s	$ 630,624						
36	June 1, 2019 Annualized Revenues w/RAM Increase & MPIR accrued 1/1/19	Col (d), lines (5+11+17 +20+23+26+32+33)	$000s		$ 636,136					
37	June 1, 2019 Annualized Revenues w/ RAM Increase & MPIR accrued 1/1/2020	Col (e), lines (5+11+17 +20+23+26+32+33)	$000s			639,450				
38	June 1, 2020 Annualized Revenues w/ RAM Increase & MPIR accrued 1/1/2020	Col (f), lines (5+14+17 +20+23+26+29+32+33)	$000s				$ 660,266	$ 660,266		
39	June 1, 2020 Annualized Revenues w/ RAM increase & MPIR accrued 12/1/2022								$ 660,998	
40	June 1, 2020 Annualized Revenues w/ RAM increase & MPIR accrued 1/1/2023									$ 662,089

Line No.	Distribution of Target Revenues by Month:	Note (1a)	Note (1)	2019	2019	Note (5a) → 2020	2020	2021	Note (6) 2022	Note (6a) 2023
41	Distribution of Target Revenues by Month:									
42	January	8.19%	8.19%	$51,648,125		52,370,974		$54,075,759		$54,225,081
43	February	7.59%	7.59%	$47,864,379		48,534,273		$50,114,165		$50,252,547
44	March	8.10%	8.10%	$51,080,563		51,795,469		$53,481,520		$53,629,201
45	April	7.98%	7.98%	$50,323,814		51,028,129		$52,689,201		$52,834,694
46	May	8.40%	8.40%	$52,972,435		53,713,820		$55,462,317		$55,615,467
47	June	8.07%	8.07%		$51,336,182		$53,283,440			$53,430,574
48	July	8.70%	8.70%		$55,343,840		$57,443,114			$57,601,734
49	August	8.94%	8.94%		$56,870,566		$59,027,752			$59,190,747
50	September	8.65%	8.65%		$55,025,772		$57,112,981			$57,270,689
51	October	8.84%	8.84%		$56,234,430		$58,367,486			$58,528,658
52	November	8.26%	8.26%		$52,544,841		$54,537,945			$54,688,543
53	December	8.28%	8.28%		$52,672,068		$54,669,998		$54,730,659	$54,820,961
54	Total Distributed Target Revenues	100.00%	100.00%	$253,889,316	$380,027,699	257,442,665	$394,442,716	$265,822,962	$54,730,659	$662,088,896

Footnotes:

1 RBA Tariff Effective February 16, 2018 to reflect 2017 test year.

1a Monthly Allocation Factors based on the number of days in the month as a percentage of the number of days in the year, with the allocation factor for February set such that the total of the monthly allocation factors sums to 100%. Effective January 2021.

2 Test Year 2017 2nd Interim Increase provided for in Order No. 35335, issued March 9, 2018 in Docket No. 2016-0328: -$603 $000s

2a Reduction for Tax Act Implementation Lag (March 2018 Settlement Tariff Sheets, Attachment 3, filed March 16, 2018, in accordance with Order No. 35335): -$2,143 $000s

3 Transmittal 18-01 filed May 29, 2018, establishing 2018 target revenue effective June 1, 2018.

4 Transmittal Nos. 19-01, 19-02, 19-03 Consolidated (Decoupling) - 2019 RBA Rate Adjustment, filed May 28, 2019, establishing 2019 target revenue effective June 1, 2019.

5 Transmittal Nos. 20-01, 20-02, 20-03 Consolidated (Decoupling) - 2020 RBA Rate Adjustment, approved in Order No. 37150, filed May 28, 2020 updated target revenues for (1) the removal of Phase 1 Grid Modernization project withholdings approved in Order No. 37146, Docket 2018-0141 and (2) revision to West Loch PV project ADIT, retroactive to January 1, 2020.

6 FOR ILLUSTRATION PURPOSES ONLY - MPIR Revenue accrual starting December 1, 2022 filed in Transmittal xx-xx, filed Month Day, Year.

6a FOR ILLUSTRATION PURPOSES ONLY - MPIR Revenue accrual starting January 1, 2023 filed in Transmittal xx-xx, filed Month Day, Year.

HAWAIIAN ELECTRIC COMPANY, INC.
DECOUPLING CALCULATION WORKBOOK
MAJOR PROJECT INTERIM RECOVERY

The purpose of this Illustration is to reflect the inclusion of the Kulanihakoi Substation Project in the year following project in service as part of the February 2023 annual MPIR true-up filing which will also include an update for all MPIR project costs recorded as of December 31, 2022 and 2023 activity.

Line No.	Description	Reference	Amount $000
	(a)	(b)	(c)
1	Schofield Generating Station	Note 1	17,532
2	Docket No. 2017-0213		
3	West Loch PV Project		3,445
4	Docket No. 2016-0342		
5	Grid Mod Phase 1 Project		388
6	Docket No. 2018-0141		
7	Kulanihakoi Substation	Schedule L4	1,823
8	Docket No. xxxx-xxxx		
7	Total MPIR Recovery		23,188
8	Revenue Tax Factor (1/(1-8.885%))		1.0975
4	**Major Project Interim Recovery Total**		25,449
			To Sch B1

The purpose of this illustration is to reflect the calculation of MPIR recovery in the year following project in service filed as part of the annual MPIR true-up filing to be filed no later than February 2023.
MPIR to be in effect until such costs are reflected in base rates.

HAWAIIAN ELECTRIC COMPANY, INC.
DECOUPLING CALCULATION WORKBOOK
REVENUE REQUIREMENT AND DETERMINATION OF MAJOR PROJECT INTERIM RECOVERY
ILLUSTRATIVE MPIR PROJECT - KULANIHAKOI SUBSTATION
$ in thousands

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

Line No.	Description	Reference	Recorded at 12/31/2022	2023 Activity	Ending Balance as of 12/31/23	Average Balance	MPIR
	(a)	(b)	(c)	(d)	(e)	(f) = ((c)+(e))/2	(g)
	Return on Investment - Kulanihakoi Substation Project						
1	Plant in Service (not to exceed PUC approved amount)	*HECO-WP-L4-001*	15,864	-	15,864	15,864	
2	Accum Depreciation	*HECO-WP-L4-001*	-	(413)	(413)	(207)	
3	Net Cost of Plant in Service		15,864	(413)	15,451	15,658	
4	ADIT	*HECO-WP-L4-002*	225	(190)	36	130	
5	State ITC	*HECO-WP-L4-002*	(285)	28	(256)	(271)	
6	Total Deductions		(59)	(161)	(221)	(140)	
7	Total Rate Base		$ 15,805	$ (574)	$ 15,231	15,518	
8	Average Rate Base					**$ 15,518**	
9	Rate of Return (grossed-up for income taxes, before rev taxes)	***Schedule L4, pg 2***				9.27%	
10	Annualized Return on Investment (before revenue taxes)						**$ 1,439**
11	Depreciation Expense (Note 1)	*HECO-WP-L4-001*				413	
12	Operating & Maintenance Expense	Not Applicable				-	
12a	Prior year reconciliation of O&M to actuals	Not Applicable				-	
13	Amortization of State ITC	see line 5, Col (d)				(28)	
14	Lease Rent Expense	Not Applicable				-	
15	Other Expense	Not Applicable				-	
16	Total Expenses						**$ 385**
17	Total Annualized Major Project Interim Recovery						**$ 1,823**
							To Sch La

Will be revised to reflect the most recent rate case rate of return.

Note 1: Depreciation expense is recorded beginning in the year after an asset is placed in service, therefore, depreciation expense is zero in year 1. The revenue requirement for year 2 and thereafter will include depreciation expense at existing, approved depreciation accrual rates at the time of filing. See further discussion at HECO-WP-L4-001.

Note 2: Transmittal No. 20-01, 20-02, 20-03 Consolidated (Decoupling) - 2020 RBA Rate Adjustment, Attachment 2, Schedule D, filed June 5, 2020.

SCHEDULE L
(To be filed Dec 2022 for Yr 1)
PAGE 1 OF 1

HAWAIIAN ELECTRIC COMPANY, INC.
DECOUPLING CALCULATION WORKBOOK
MAJOR PROJECT INTERIM RECOVERY

The purpose of this Illustration is to reflect the inclusion of the Kulanihakoi Substation Project upon date in service. The December 2022 filing will also include an update of all MPIR project costs recorded as of December 31, 2021 and 2022 activity filed as part of he February 2022 annual MPIR true-up filing.

Line No.	Description	Reference	Amount $000
	(a)	(b)	(c)
1	Schofield Generating Station	Note 1	17,532
2	Docket No. 2017-0213		
3			3,445
4	Docket No. 2016-0342		
5	Grid Mod Phase 1 Project		388
6	Docket No. 2018-0141		
7	Kulanihakoi Substation	Schedule L4	733
8	Docket No. xxxx-xxxx		
7	Total MPIR Recovery		22,098
8	Revenue Tax Factor (1/(1-8.885%))		1.0975
4	**Major Project Interim Recovery Total**		24,252
			To Sch B1

The purpose of this illustration is to reflect the mid-year convention for plant placed into service in November 2022.
MPIR to be in effect until such costs are reflected in base rates.

HAWAIIAN ELECTRIC COMPANY, INC.
DECOUPLING CALCULATION WORKBOOK
REVENUE REQUIREMENT AND DETERMINATION OF MAJOR PROJECT INTERIM RECOVERY
ILLUSTRATIVE MPIR PROJECT - KULANIHAKOI SUBSTATION
$ in thousands

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

Line No.	Description	Reference	Recorded at 12/31/2021	Recorded at In Service Date (Nov 2022)	Ending Balance as of 11/30/22	Average Balance	MPIR
	(a)	(b)	(c)	(d)	(e)	(f) = ((c)+(e))/2	(g)
	Return on Investment - Kulanihakoi Substation Project						
1	Plant in Service (not to exceed PUC approved amount)	*Schedule L4.1*	-	15,864	15,864	7,932	
2	Accum Depreciation	Note 1	-	-	-	-	
3	Net Cost of Plant in Service		-	15,864	15,864	7,932	
4	ADIT	*HECO-WP-L4-002*	-	225	225	113	
5	State ITC	*HECO-WP-L4-002*	-	(285)	(285)	(142)	
6	Total Deductions		-	(59)	(59)	(30)	
7	Total Rate Base		$ -	$ 15,805	$ 15,805	7,902	
8	Average Rate Base					**$ 7,902**	
9	Rate of Return (grossed-up for income taxes, before rev taxes)	*Schedule L4, pg 2*	Will be revised to reflect the most recent rate case rate of return.			9.27%	
10	Annualized Return on Investment (before revenue taxes)						**$ 733**
11	Depreciation Expense (Note 1)	Not Applicable				-	
12	Operating & Maintenance Expense	Not Applicable				-	
12a	Prior year reconciliation of O&M to actuals	Not Applicable				-	
13	Amortization of State ITC	Not Applicable				-	
14	Lease Rent Expense	Not Applicable				-	
15	Other Expense	Not Applicable				-	
16	Total Expenses						**$ -**
17	Total Annualized Major Project Interim Recovery						**$ 733** *To Sch L*

Note 1: Depreciation expense is recorded beginning in the year after an asset is placed in service, therefore, depreciation expense is zero in year 1. The revenue requirement for year 2 and thereafter will include depreciation expense at existing, approved depreciation accrual rates at the time of filing.

Hawaiian Electric Company, Inc.

Revenues at Current Effective Rates
COMPOSITE EMBEDDED COST OF CAPITAL
Estimated 2020 Average

Excerpt from PUC-IR-41, Attachment 2A.

In Decision & Order No. 37387 issued on October 22, 2020 in Docket No. 2019-0085, the Commission approved the Settlement Letter, whereby the Parties agreed on the weights and earnings requirements for short-term debt, long-term debt, and preferred stock, and that Hawaiian Electric's ROE and equity ratio for Hawaiian Electric should mirror HELCO's 2019 test year rate case.
The Settlement Agreement rate of return applied an ROE of 9.50% and total equity ratio of 58.00% based on Final Decision and Order No. 37237 issued on July 28, 2020, in Docket No. 2018-0368).

	A	B	C	D	E	F
	Capitalization					
	Amount in Thousands	Percent of Total	Earnings Reqmts	Weighted Earnings Reqmts (B) x (C)	INCOME TAX FACTOR (Note 1)	PRETAX WEIGHTED EARNINGS REQMTS
Short-Term Debt	14,690	0.58	2.50%	0.01%	1.0000	0.0100%
Long-Term Debt	1,044,127	41.42	4.55%	1.88%	1.0000	1.8800%
Preferred Stock	21,302	0.85	5.33%	0.05%	1.3468	0.0673%
Common Equity	1,440,676	57.15	9.50%	5.43%	1.3468	7.3133%
Total	2,520,795	100.00				
Estimated Composite Cost of Capital				7.37%		9.27%
						1.0975
Estimated Pretax Composite Cost of Capital						10.175%

Source: Settlement Agreement, Exhibit 1

Note 1: Composite Federal & State Income Tax Rate 25.75%
Income Tax Factor (1 / 1-tax rate) 1.3468354

SCHEDULE L4.1
(To file by Dec 2022 for Yr 1)
PAGE 1 OF 1

HAWAIIAN ELECTRIC COMPANY, INC.
DECOUPLING CALCULATION WORKBOOK
REVENUE REQUIREMENT AND DETERMINATION OF MAJOR PROJECT INTERIM RECOVERY
ILLUSTRATIVE MPIR PROJECT DETAIL - KULANIHAKOI SUBSTATION
$ in thousands

Line No.	Grandparent # or Project #	Description	Docket No.	Actual In Service Date	Recorded at In Service Date
	(a)	(b)	(c)	(d)	(e)
1	PZ.005089	Kulanihakoi Substation	Docket No. xxxx-xxxx	Nov 2022	15,864
2		**Total Project Costs**			**15,864**
					To Sch L4

Source: HECO-WP-L4-001

HAWAIIAN ELECTRIC COMPANY, INC.
Kulanihakoi SUBSTATION
2022 & 2023 Major Projects Interim Recovery Depreciation Summary - ESTIMATE

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

[1] Project #	[1] Project	Project Type	Date In Service	[1] Actual Net Plant Adds Thru 12/31/21	2022 Activity	[1] Actual Net Plant Adds Thru 12/31/22	Plant Acct	[2] PUC Approved Accrual Rate	[3] 2023 Depr
				(A)	(B)	(C) = (A) + (B)		(D)	(E) = (C) * (D)
PZ.005089	Substation	Project	Nov 2022	-	9,732,956	9,732,956	353	0.0239	232,618
Kulanihakoi Substation	Transmission < 69 kV	Project	Nov 2022		5,533,345	5,533,345	355	0.0254	140,547
	Telecom	Project	Nov 2022	-	598,094	598,094	397	0.0667	39,893
	Land - [4]	Project	Nov 2022	-	-	-	3501	0.0119	- [4]
				-	15,864,395	15,864,395			413,057
						To Sch L4.1			*To Sch L4a / HECO-WP-L4-002 p.1*

[1] Source: HECO-WP-L4-002, page 5.

[2] Depreciation rates applied will be per the latest Commission rate case order. Rates in this illustration based on rates approved in Docket No. 2016-0431. Per Docket No. 2016-0431, filed July 30, 2018, consolidated depreciation and amortization rates and revised CIAC amortization period will be effective with the date of interim or final rates in the Company's subsequent general rate case proceedings, beginning with MECO's ongoing 2018 test year general rate case (or HECO's 2020 test year).

[3] Included in MPIR recovery until total project costs are reflected in the next test year rate case base rates.

[4] Land for the Kulanihakoi Substation is estimated to be 100% in-kind CIAC from the developer, resulting in a net $0 cost. The in-kind CIAC total of $1,500,000 has been included in the calculation of ADIT at HECO-WP-L4-002, page 1.

	Land Cost	
Land Cost	1,500,000	
In-Kind CIAC	(1,500,000)	*To HECO-WP-L4-002 p.1*
Land Cost, net of CIAC	-	

HAWAIIAN ELECTRIC CO., INC.
KULANIHAKOI SUBSTATION
ADIT
DECEMBER 31, 2022 & 2023 - ESTIMATE

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

		Source	Tax Depreciation	AFUDC	Tax Cap Interest	State ITC	CIAC	2022 Total	Year 2 Tax Depreciation	State ITC	2023 Total
	FEDERAL DEFERRED TAXES						*From Page 5*				
1	State		(582,658)	(826,166)	499,325	284,752	1,500,000	875,253	(1,121,656)		(1,121,656)
2	Add back Book Depreciation	*HECO-WP-L4-001*							413,057	(28,475)	384,582
3	Subtotal	Line 1 + Line 2	(582,658)	(826,166)	499,325	284,752	1,500,000	875,253	(708,599)	(28,475)	(737,074)
4	Effective Federal Tax Rate		19.7368%	19.7368%	19.7368%	19.7368%	19.7368%	19.7368%	19.7368%	19.7368%	19.7368%
5	Federal Deferred Tax on State Book/Tax Diff	Line 3 * Line 4	(114,998)	(163,059)	98,551	56,201	296,052	172,747	(139,855)	(5,620)	(145,475)
6	Addback State Depreciation	Line 3	582,658	826,166	(499,325)	(284,752)	(1,500,000)	(875,253)	1,121,656	-	1,121,656
7	Federal Book/Tax Difference		(582,658)	(826,166)	499,325	284,752	1,500,000	875,253	(1,121,656)	-	(1,121,656)
8		Line 2	-								
9	Federal State Difference	Line 6 + 7 + 8	-	-	-	-	-	-	-	-	-
10	Tax Rate on Federal Only Adjustment		21%	21%	21%	21%	21%	21%	21%	21%	21%
11	Federal Deferred Tax Adjustment	Line 9 * Line 10	-	-	-	-	-	-	-	-	-
12	Total Federal Deferred Taxes	Line 5 + Line 11	(114,998)	(163,059)	98,551	56,201	296,052	172,747	(139,855)	(5,620)	(145,475)
	STATE DEFERRED TAXES										
13	State	Line 1	(582,658)	(826,166)	499,325	284,752	1,500,000	875,253	(1,121,656)	-	(1,121,656)
14	Add back Book Depreciation	Line 2	-	-	-	-		-	413,057	(28,475)	384,582
15	Subtotal	Line 1 + Line 2	(582,658)	(826,166)	499,325	284,752	1,500,000	875,253	(708,599)	(28,475)	(737,074)
16	Effective State Tax Rate		6.0150376%	6.0150376%	6.0150376%	6.0150376%	6.0150376%	6.0150376%	6.0150376%	6.0150376%	6.0150376%
17	Total State Deferred Taxes	Line 15 * Line 16	(35,047)	(49,694)	30,035	17,128	90,226	52,647	(42,622)	(1,713)	(44,335)
18	**TOTAL DEFERRED TAXES**	Line 12 + Line 17	(150,045)	(212,753)	128,586	73,329	386,278	225,394	(182,477)	(7,333)	(189,810)
								To Sch L4			*To Sch L4a*
											35,584
											To Sch L4a

NOTE> ADIT calculation resulting from the estimated November 2022 plant addition will be included in the annual MPIR true-up filing to be filed no later than February 2023.

HAWAIIAN ELECTRIC CO., INC.
TAX DEPRECIATION
KULANIHAKOI SUBSTATION
DECEMBER 31, 2022 & 2023 ESTIMATE

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

Project No.	Description	Book Basis	Less: AFUDC	Add: TCI	Tax Basis	Plant Acct	Life	Year 1 2022	Year 2 2023
FEDERAL									
	Kulanihakoi Substation	9,732,956	(501,075)	302,844	9,534,725	Distr	20	357,552	688,312
	Kulanihakoi Substation	5,533,345	(301,739)	182,367	5,413,973	Distr	20	203,024	390,835
	Kulanihakoi Substation	598,094	(23,352)	14,114	588,856	Comm	20	22,082	42,509
	Kulanihakoi Substation	-	-	-	-	Land	0		
	Total	15,864,395	(826,166)	499,325	15,537,554			582,658	1,121,656
								To Page 1	*To Page 1*
HAWAII									
	Kulanihakoi Substation	9,732,956	(501,075)	302,844	9,534,725	Distr	20	357,552	688,312
	Kulanihakoi Substation	5,533,345	(301,739)	182,367	5,413,973	Distr	20	203,024	390,835
	Kulanihakoi Substation	598,094	(23,352)	14,114	588,856	Comm	20	22,082	42,509
	Kulanihakoi Substation	-	-	-	-	Land	0		
	Total	15,864,395	(826,166)	499,325	15,537,554			582,658	1,121,656
								To Page 1	*To Page 1*

NOTE> No bonus depreciation on public utility property placed in service after 9/27/17.

NOTE 1> Basis includes estimated November 2022 plant addition.

HAWAIIAN ELECTRIC CO., INC.
AFUDC/TCI ON KULANIHAKOI SUBSTATION
DECEMBER 31, 2022 & 2023 ESTIMATE

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

	AFUDC	
Substation	501,075	
T&D	301,739	
Telecom	23,352	
Land	-	
Total	826,166	***From Page 5***
	0.604388	***To Page 5***
TCI	499,325	

Source: Tax Return workpapers

Annual - TCI Incurred to AFUDC Incurred Ratio

	2014	2015	2016	2017	2018	5 Yr Ave
TCI	5,037,146	4,766,793	5,326,130	8,854,169	7,919,583	31,903,821
AFUDC	8,390,248	7,607,949	9,143,928	14,847,230	12,797,647	52,787,002
Ratio	0.600357	0.626554	0.582477	0.596352	0.618831	0.604388
						To Page 5

HAWAIIAN ELECTRIC CO., INC.
TAX CREDITS - KULANIHAKOI SUBSTATION
DECEMBER 31, 2022 & 2023 ESTIMATE

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

		STATE	FED
State ITC Calculation			
Total Materials & Outside Construction	***From Page 5***	7,118,802	
State ITC %		4%	
State ITC - 2022	***To Page 1***	284,752	***To Sch L4***
Amortization of State ITC	***To Page 1***	(28,475)	***To Sch L4a***
State ITC, ending balance - 2023		256,277	***To Sch L4a***

Note: 10 year State ITC tax amortization begins the year after an asset is placed in service.

HAWAIIAN ELECTRIC COMPANY, INC.
KULANIHOKU SUBSTATION PROJECT COST BY MAJOR AREA
DECEMBER 31, 2022 & 2023 ESTIMATE

To the extent that recovery via the test year varies from actual costs incurred, a MPIR true-up adjustment will be made in the subsequent annual MPIR true-up filing.

	Book Life:	55	50/60	15			
	Tax Life:	20	20	20			
Kulanihakoi Substation		**Substation**	**T&D**	**Telecom**	**Land**	**Grand Total**	**State ITC**
Outside Services - Other		1,888,589	658,833	197,353	-	2,744,775	
Outside Services - Construction		2,524,487	1,159,209	85,601	-	3,769,297	
Material		1,957,977	1,309,992	81,536	-	3,349,505	7,118,802
Labor		963,123	792,459	76,527	-	1,832,109	***To Page 4***
Other		-	-	-	1,500,000	1,500,000	
Overheads		1,897,705	1,311,113	133,725	-	3,342,543	
AFUDC		501,075	301,739	23,352	-	826,166	***To Page 3***
Less: In-Kind CIAC		-	-	-	(1,500,000)	(1,500,000)	***To Page 1***
		9,732,956	5,533,345	598,094	-	15,864,395	
Less AFUDC		(501,075)	(301,739)	(23,352)	-	(826,166)	
Add TCI	0.604388	302,844	182,367	14,114	-	499,325	
	From Page 3						
Tax Basis		9,534,725	5,413,973	588,856	-	15,537,554	***To Page 2***

Source: SAP/PowerPlan WBS.

Ho'opili Substation GHG Analysis
O'ahu, HI
Table of Contents

Table Number		Tab Name	Table Name
1	Table 1	Project Emissions	Project GHG Emissions by Stage
2	Table 2	Inputs + Assumptions	Project Specific Inputs and Assumptions
A1	Appendix Table A1	RMEM	Raw Materials Extraction & Manufacturing Transmission Line and Distribution GHG Emissions Calculations
A2	Appendix Table A2	Transportation	Material Transportation GHG Emissions Calculations
A3	Appendix Table A3	Construction	Construction GHG Emissions Calculations
A4	Appendix Table A4	Use (O&M)	Operational GHG Emissions Calculations
A5	Appendix Table A5	Decom. & Disposal	Decommissioning & Disposal GHG Emissions Calculations

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Table 1
Project GHG Emissions by Stage
Ho'opili Substation GHG Analysis
O'ahu, HI

Project Stage		GHG Emissions (MT CO_2e)[1]
Upstream[2]	Raw Materials Extraction & Production	580
	Transportation & Distribution	108
	Construction	726
Operational	Operations & Maintenance	5.2
Downstream[3]	Transportation & Distribution	14
	Decommissioning and Disposal	41
	Total Project Operational[4]	**5.2**
	Total Project Lifecycle[5]	**1,474**

Notes:

1. This table summarizes results from the GHG Analysis undertaken to determine Project GHG Emissions. The supporting calculations are provided in the Calculation tabs for each Project Stage; each tab provides live cell logic, references, calculations and formulas unhidden and unprotected. Note that numbers may not add to totals due to rounding.

2. Upstream Transportation & Distribution and Construction Stages include all construction and transportation activity related to the installation of the proposed substation, overhead transmission line, and underground transmission line, as described in more detail in the Transportation and Construction calculation tables.

3. Downstream decommissioning and disposal emission includes emissions associated with the decommissioning and disposal of the proposed equipment.

4. Total Project Operational includes GHG emissions from the Operational stage of the Project.

5. The Project GHG Emissions estimates are based on the most current information including emissions factors available to Ramboll at the time the analysis was completed.

Abbreviations:

CO_2e - Carbon dioxide equivalent
GHG - Greenhouse Gas
MT - Metric Tons

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Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
General Project	**General Project**			
	Project lifetime	55	yr	Provided by developer
Underground Transmission Line	**Underground Transmission Line**			
	Transmission Line Voltage	46	kV	Provided by developer
	Transmission Line Material	Aluminum	--	Provided by developer
	Transmission Line Insulation	Cross-Linked Polyethylene Jacket	--	Provided by developer
	Location of Transmission Line Manufacturer	Abbeville, South Carolina	--	Provided by developer
	Length of Transmission Line per Conduit	1,165	ft	Provided by developer, includes underground transmission line to be installed inside of substation.
	Weight of Transmission Line	6,738	kg	From HECO std 21-1010 approximate cable weight for 1/C of 1500 KCM AL 46KV underground cable is 4.25 lbs/ft. Multiple by 3 for 3 phase cable. Underground transmission line does not have circuit breakers and insulators.
	# of Conduits per Ductbank	4	--	Provided by developer
	Conduit Duct Material	PVC	--	Provided by developer
	Conduit Duct (Inner) Diameter	5	in	Provided by developer
	Location of Conduit Duct Manufacturer	Milford, UT	--	Assuming Heritage Plastic Utah Location.[1]
	Weight of Conduit Duct	10,984	lb	Calculated based on 2.357 lb/ft from 5" PVC Utility Duct - Type DB-120 for Direct Burial Rated for use with 90° C Wire.[2]
	Total Length of Conduit Duct	4,660	ft	Provided by developer, includes underground transmission line to be installed inside of substation (1,165 feet multiplied by the number of conduits per duct bank).
	Ductbank Casing (Containing Transmission Line + Conduit Duct) Material	Thermal Concrete	--	Provided by developer
	Ductbank Casing Dimensions (Length x Width)	18" x 18"	square inches	Provided by developer
	Length Of Ductbank Casing	1,165	ft	Provided by developer, includes underground transmission line to be installed inside of substation.
	Volume of Duct Bank	2,621	cuft	Calculated based on Duct Bank Casing Dimensions and Length of Duct Bank Casing.
	Weight of Duct Bank	393,188	lb	Calculated based on concrete density of 150 lb/cuft that the developer provided for Thermal Concrete for Koa Ridge, Salt Lake, East Kapolei GHG analysis projects.
	Material to Surround Ductbank	Fluidized Thermal Backfill (FTB)	--	Provided by developer
	Volume of Material to Surround Ductbank	7,573	cuft	Calculated based on guidance developer provided for Koa Ridge, Salt Lake, East Kapolei GHG analysis projects.
	Weight of Material to Surround Ductbank	1,082,868	lbs	Calculated based on concrete density of 143 lb/cuft that the developer provided for Fluidized Thermal Backfill for Koa Ridge, Salt Lake, East Kapolei GHG analysis projects.
	Percent of Thermal Concrete Materials Manufactured in British Columbia	21%	--	Based on information the developer provided for Thermal Concrete for previous GHG analysis projects, the remaining Thermal Concrete Materials are manufactured locally in Hawaii.

Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Underground Transmission Line	**Percent of Fluidized Thermal Backfill (FTB) Manufactured in British Columbia**	25%	--	Based on information the developer provided for Fluidized Thermal Backfill for Koa Ridge, Salt Lake, East Kapolei GHG analysis projects, the remaining Fluidized Thermal Backfill Materials are manufactured locally in Hawaii.
	Location(s) of Concrete Manufacturer	British Columbia, Canada Kapolei, Hawaii	--	Based on information the developer provided for Koa Ridge, Salt Lake, East Kapolei GHG analysis projects.
	Equipment Lifetime	60	yr	Equipment lifetime based on Hawaiian Electric's Depreciation Study for underground conduit.
	Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Abandoned in place		Provided by developer
Overhead Transmission Line	**Overhead Transmission Line**			
	Transmission Line Voltage	46	kV	Provided by developer
	Transmission Line Material	Aluminum	--	Provided by developer
	Transmission Line Insulation	N/A (Bare Conductor)	--	Provided by developer (T&D Engineering)
	Transmission Line Manufacturer	Kaiser Aluminum		Provided by developer
	Location of Transmission Line Manufacturer	Florence, Alabama	--	Provided by developer
	Length of Transmission Line	13,800	ft	Provided by developer
	Weight of Transmission Line - Bulk of System	4,933	kg	Estimated by developer based on value of 0.522 lb/ft for 556 AL conductor, assumption of 3 insulators per pole (for a total of 73 poles) and weight of 20 lbs per insulator. (Maclean insulators - NPKG20XGO17S0)
	Equipment Lifetime	45	yr	Equipment lifetime based on Hawaiian Electric's Depreciation Study for overhead conductors and devices.
	Number of Equipment over Project Lifetime	2	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Transmission lines get recycled - Provided by developer. Assuming transmission lines will be disposed of to be more conservative.
Fiber Optic Cable	**Fiber Optic Cable**			
	Fiber Optic Cable Type	ADSS (All Dielectric Self-Supporting) Cable	--	Provided by developer
	Fiber Optic Insulation	Polyethylene	--	Provided by developer
	Material Code for Fiber Optic Cable	DNA-32107	--	Provided by developer
	Model of Fiber Optic Cable	AE144APCC11BA3	--	Provided by developer
	Number of Fibers	144	--	Provided by developer
	Fiber Optic Cable Weight	0.216	lb/ft	Provided by developer
	Total Length of Fiber Optic Cable	11,468	ft	Provided by developer
	Total Fiber Optic Cable Weight	2,477	lb	Calculated based on information provided by developer
	Fiber Optic Cable Manufacturer	AFL	--	Provided by developer
	Location of Fiber Optic Cable Manufacturer	Duncan, South Carolina	--	Provided by developer
	Equipment Lifetime	15	yr	Provided by developer
	Number of Equipment over Project Lifetime	4	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer

Table 2
Project Specific Inputs and Assumptions
Ho'opili Substation GHG Analysis
O'ahu, HI

	Description	Number	Unit	Reference
Misc. Equipment to be installed as part of Project	**Manholes/Handholes**			
	Number of Manholes	6	item	Provided by developer
	Dimensions of Manholes	6' x 14'	square feet	Provided by developer
	Manhole Material	Concrete	--	Provided by developer
	Manhole Weight	51,334	lb/item	Based on weight provided by client for East Kapolei GHG Analysis for 6x14 manholes
	Manhole Volume	754	cuft	Based on weight provided by client for East Kapolei GHG Analysis for 6x14 manholes
	Manhole Cover Material	Steel	--	Provided by developer
	Weight of Manhole Cover	290	lbs	Provided by developer
	Location of Manhole & Manhole Cover Manufacturer	Kapolei, Hawaii	--	Developer requested that the Hawaii location be used.[3]
	Equipment Lifetime	60	yr	Provided in PUC Application #2010-0053. Assume that manholes/handholes have same average service life as underground conduit.
	Number of Equipment over Project Lifetime	6	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	Number of Handholes	0	item	Provided by developer
	Switchgears			
	Total Number of Switchgears	1	item	Provided by developer
	Voltage of Switchgears	15	kV	Provided by developer
	Manufacturer of Switchgears	Eaton	--	Provided by developer
	Weight of Each Switchgear	5,896	kg	Provided by developer, estimated weight without the circuit breakers
	Location of Switchgear Manufacturer	Omaha, Nebraska	--	Provided by developer
	Switchgear Insulation Material	Glass-Polyester	--	Provided by developer
	Number of Concrete Pads	1	item	Provided by developer
	Cubic Feet of Concrete	304.6	cuft	Provided by developer
	Concrete Pad Dimensions	9'8" x 21' x 1'6"	per pad	Provided by developer
	Weight of Concrete	45,690	lbs	Calculated based on 150 lb/cuft, density of concrete was provided by developer.
	Percent of Concrete Materials Manufactured in British Columbia	21%	--	Based on information the developer provided for Thermal Concrete for Koa Ridge, Salt Lake, East Kapolei GHG analysis projects, the remaining Thermal Concrete Materials are manufactured locally in Hawaii.
	Equipment Lifetime	55	yr	Provided by developer
	Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer

Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Misc. Equipment to be installed as part of Project	**Switches**			
	Total Number of Switches	Not in project scope		No switches for line extension, provided by developer
	Transformers			
	Total Number of Transformers	1	item	Provided by developer
	Transformer Rating	10/12.5	MVA	Provided by developer
	Weight of Each Transformer	84,063	lbs	Provided by developer
	Location of Transformer Manufacturer	South Boston, Virginia	--	Provided by developer
	Equipment Lifetime	55	yr	Provided by developer
	Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	Utility Poles (Wood & Steel)			
	Number of Wood Utility Poles	61	item	Provided by developer
	Height of Wood Utility Poles	65	ft	Provided by developer
	Weight of Each Wood Utility Pole	2,993	lb	Estimated based on Class 1, 65ft Length from McFarland Cascade.[4]
	Location of Wood Utility Pole Manufacturer	Tacoma, Washington	--	Provided by developer
	Wood Pole Equipment Lifetime	58	yr	Provided by developer
	Number of Equipment over Project Lifetime	61	item	Estimated based on lifetime of equipment and Project lifetime.
	Wood Pole End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	Number of Steel Utility Poles	12	item	Provided by developer
	Height of Steel Utility Poles	65	ft	Provided by developer
	Weight of Each Steel Utility Pole	2,000	kg	Provided by developer
	Location of Steel Utility Pole Manufacturer	Valley, Nebraska	--	Provided by developer
	Number of Foundations for Steel Utility Poles	3	item	Provided by developer
	Material of Foundation	Concrete	--	Confirmed by developer
	Dimensions of Concrete Foundation	2' x 2' x 2	per foundation	Confirmed by developer
	Weight of Each Concrete Foundation	3,600	lb	Calculated based on 150 lb/cuft, density of concrete was provided by developer
	Percent of Concrete Materials Manufactured in British Columbia	21%	--	Based on information the developer provided for Thermal Concrete for previous GHG analysis projects, the remaining Thermal Concrete Materials are manufactured locally in Hawaii.
	Steel Pole and Foundation Equipment Lifetime	58	yr	Provided by developer
	Number of Equipment over Project Lifetime	12	item	Estimated based on lifetime of equipment and Project lifetime.
	Steel Pole and Foundation End of Life Requirements	Dispose upon decommissioning	--	Provided by developer

Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Misc. Equipment to be installed as part of Project	**12kV Splices**			
	Total Number of Splices	6	item	Provided by developer
	Model of Splices	Elastimold 15PCJ-1-N-1-410	--	Provided by developer
	Weight of Each Splice	0.45	kg	Product manufacturer specifications[5]
	Location of Splice Manufacturer	Memphis, Tennessee	--	Provided by developer
	Equipment Lifetime	45	yr	Provided by developer
	Number of Equipment over Project Lifetime	12	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	46kV Splices			
	Total Number of Splices	15	item	Provided by developer
	Model of Splices	TE Connectivity / Raychem EVHS-6902-HECO-1500	--	Provided by developer
	Weight of Each Splice	1.8	kg	Based on weight of 1.8 kg/item from Thomas & Betts manufacturer's brochure[6]
	Location of Splice Manufacturer	Wilsonville, Oregon	--	Heat-shrink tubing location available from product manufacturer[7]
	Equipment Lifetime	45	yr	Provided by developer
	Number of Equipment over Project Lifetime	30	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	Light Fixtures			
	Number of Light Fixtures	5	item	Provided by developer
	Manufacturer and Model of Light Fixtures	CREE Type ARE-EDG-3M-AA-14-D-UL-BZ-525-R	--	Provided by developer
	Weight of Each Light Fixture	17	kg	Based on information from manufacturer for ARE-EDG-3M-14[8]
	Light Wattage	232	W/item	Provided by developer
	Lighting Chemistry	LED	--	Provided by developer
	Equipment Lifetime	65	yr	Provided by developer, Per Deprecation Study - Average Service Life
	Number of Equipment over Project Lifetime	5	item	Estimated based on lifetime of equipment and Project lifetime.
	Location of Light Fixture Manufacturer	Durham, North Carolina	--	Based on information from manufacturer's website[9]
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer

Table 2
Project Specific Inputs and Assumptions
Ho'opili Substation GHG Analysis
O'ahu, HI

	Description	Number	Unit	Reference
Misc. Equipment to be installed as part of Project	**Lightning Arrestors**			
	Total Number of Lightning Arrestors	6	item	Provided by developer
	Voltage of Lightening Arrestors	36	kV	Provided by developer
	Manufacturer and Model of Lightning Arrestors	ABB, Q036SA029A	--	Provided by developer
	Weight of Each Lightening Arrestor	15	kg	Manufacturer's brochure[10]
	Location of Lightning Arrestor Manufacturer	Mt. Pleasant, PA	--	Provided by developer
	Equipment Lifetime	55	yr	Provided by developer
	Number of Equipment over Project Lifetime	6	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	Surge Arrestor			
	Total Number of Surge Arrestors	Not in project scope		None planned unless recommended per coordination study, provided by developer
	Transformer Fuses			
	Total Number of Fuses	3	item	Provided by developer (fuses for transformers only, no fuses for line extension)
	Voltage of Fuses	46	kV	Provided by developer
	Manufacturer and Model of Fuses	S&C SMD-1A	--	Provided by developer
	Material of Fuse Mount	Galvanized Steel	--	Provided by developer from descripted bulletin (Principal Parts of an SMD Power Fuse)
	Weight of Each Fuse	10	lb	Provided by developer
	Weight of Each Fuse Mount on Transformer	220	lbs	Subtracted fuse weight from weight provided for all components by the developer
	Total Weight of Each Fuse and Fuse Mount on Transformer	230	lbs	Provided by developer, 688.5lbs for all 3 fuses and 3 fuse mounts
	Location of Fuse Manufacturer	Chicago, Illinois	--	Provided by developer
	Equipment Lifetime	55	yr	Provided by developer
	Number of Equipment over Project Lifetime	3	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	Distributed Discrete I/O (DDIO) Control Device & Remote Terminal Units (RTU)			
	Total Number of DDIOs	4	item	Three DDIO's in switchgear and 1 in transformer control cabinet, provided by developer
	Model of DDIOs	NOVATECH DDIO-SER-B-WR-110-LV-42-R	--	Provided by developer
	Weight of Each DDIO	1.35	kg	Manufacturer's brochure[11]
	Location of DDIOs Manufacturer	Lenexa, Kansas	--	Provided by developer
	Total Number of RTUs	1	item	Provided by developer
	Model of RTUs	NOVATECH ORIONLX-B9-ENXX-CPX-XM4-ILV-HVXX-01-04-42-44-46-83-HECO	--	Provided by developer
	Weight of Each RTU	4.3	kg	Manufacturer's brochure[12]
	Location of RTUs Manufacturer	Lenexa, Kansas	--	Provided by developer
	Equipment Lifetime	55	yr	Provided by developer
	Number of DDIOs over Project Lifetime	4	item	Estimated based on lifetime of equipment and Project lifetime.
	Number of RTUs over Equipment Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer

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Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Misc. Equipment to be installed as part of Project	**Battery & Misc. Battery Equipment**			
	Number of Batteries	8	item	Provided by developer
	Battery Chemistry	Lead Calcium	--	Provided by developer
	Battery Model, Capacity	C&D 3DJ-07HP, rated at 175AH	--	Provided by developer
	Weight of Each Battery	46	kg	Manufacturer's brochure[13]
	Location of Battery Manufacturer	Mexico	--	Manufacturer's website[14]
	Number of Battery Cabinets	1	item	Provided by developer
	Battery Cabinet Manufacturer and Model	Eaton, PEDERSEN CAB, BATT, SE1	--	Provided by developer
	Weight of Each Battery Cabinet	544	kg	Provided by developer from Eaton Manufacturing drawings.
	Location of Battery Cabinet Manufacturer	Omaha, Nebraska	--	Provided by developer
	Number of Battery Chargers	1	item	Provided by developer
	Battery Charger Specifications	25A, 48VDC, 240VAC	--	Provided by developer
	Battery Charger Manufacturer and Model	Enersys AT048025E240SXXXGL	--	Provided by developer
	Weight of Each Battery Charger	55	kg	Provided by developer
	Location of Battery Charger Manufacturer	Warminster, Pennsylvania	--	Easton, PA provided by developer, EnerSys manufacturing is located roughly 130 miles from Easton in Warminster, PA.[15]
	Equipment Lifetime	55	yr	Provided by developer
	Number of Batteries per Project Lifetime	8	item	Estimated based on lifetime of equipment and Project lifetime.
	Number of Battery Cabinents per Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
	Number of Battery Chargers per Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer
	Circuit Breakers			
	Number of Circuit Breakers	2	item	Provided by developer
	Circuit Breaker Voltage	15	kV	Provided by developer
	Model of Circuit Breaker	VCP-W	--	Provided by developer
	Manufacturer of Circuit Breaker	Eaton	--	Provided by developer
	Weight of Circuit Breaker	350	lb/item	Provided by developer
	Location of Circuit Breaker Manufacturer	Arecibo, Puerto Rico	--	Provided by developer
	Equipment Lifetime	55	yr	Provided by developer
	Number of Equipment over Project Lifetime	2	item	Estimated based on lifetime of equipment and Project lifetime.
	End of Life Requirements	Dispose upon decommissioning	--	Provided by developer

Table 2
Project Specific Inputs and Assumptions
Ho'opili Substation GHG Analysis
O'ahu, HI

	Description	Number	Unit	Reference
Proposed Substation and Equipment	**Substation**			
	Area of New Substation	3,300	m^2	Provided by developer in Low Profile Ultimate Plan Distribution Substation schematic.
	Number of Substation Bays	1	item	Based on diagram provided by developer, "Low profile template 4-unit Ulitmate.pdf". Note: there is space for 4 bays, but currently the project has only 1 transformer and switchgear.
	Transformer Rating	10,000	kVA per transformer	Provided by developer
	Transformer Rating	37	tonnes	Based on "Basic Civil Engineering" information provided in Harrison, et al. (2010) for a 20,000m^2 substation scaled to approximate area of the Ho'opili Substation.[16]
	Limestone Chipping	1,109	tonnes	
	Fencing	6	tonnes	
	Basic Engineering & Substation Bay Materials	1,281,700	kg	Based on "Basic Civil Engineering" information provided in Harrison, et al. (2010) for a 20,000m^2 substation scaled to approximate area of the Ho'opili Substation.[16] This does not include weights for circuit breakers.
	Percent of Basic Engineering & Substation Bay Materials Manufactured in British Columbia	21%	--	Based on information the developer provided for Thermal Concrete for Koa Ridge GHG Analysis, the remaining Basic Engineering & Substation Bay Materials are manufactured locally in Hawaii.
	Substation - Bulk of System - Aluminum	200	kg	Based on "Basic Civil Engineering" - Aluminum information provided in Harrison, et al. (2010) for a 20,000m^2 substation scaled to approximate area of the Ho'opili Substation.[16]
	Substation - Bulk of System - Steel	10,240	kg	Based on "Basic Civil Engineering" - Steel information provided in Harrison, et al. (2010) for a 20,000m^2 substation scaled to approximate area of the Ho'opili Substation.[16]
	Substation Lifetime	55	yr	Equipment lifetime based on Hawaiian Electric's Depreciation Study for Station Equipment - Substations.

Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Existing equipment to be removed/disposed	**Existing equipment to be removed/disposed**			
	Number Utility Poles	Not in project scope		Provided by developer
	Material of Utility Poles			
	Length of Transmission Line			
	Overhead Transmission Line System - Decommissioning			
	Underground Transmission Line System - Decommissioning			
	Number of Switchgears			
	Weight of Switchgears			
	Number of Transformers			
	Transformer Weight			
	Deconstruction of Substations			
	Misc. Equipment to be Removed			
Decommissioning & Disposal of Entire Proposed Project at End of Life	**Decommissioning & Disposal of Entire Proposed Project at End of Life**			
	Decommissioning/deconstruction activities - New Materials / Equipment	Transformers, switchgears, overhead transmission line conductor, manholes, manhole covers, and utility poles removed and disposed. Underground transmission line, switchgear concrete pad, and conduit duct installed for this project will be abandoned in place.		--
	Decommissioning Intensity Relative to Construction	3%	%	Based on GHG emissions estimated for construction and deconstruction phases for the Southern California Edison's Lakeview Substation Project, which is of similar scope to this Project.[17]

Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Construction	**Substation Construction**			
	Subphases (days)	Grade site (40 days), Steel Fabrication (40 days), CSA Substation construction (50 days), Finish 46kV ductline (2 days), Final gravel & paving (5 days), Install Structures & Switches (40 days), Install Transformer/Switchgear (10 days), Interconnection wiring (40 days), Pre-Energization Checks/Install Relay Settings (25 days), Final Testing (20 days)		Provided by developer, except "Install Transformer/Switchgear" subphase which was scaled based on the GHG analysis for Army Privatization Project C-3.
	Overall Construction Duration	272	days	Provided by developer and scaled based on the GHG analysis for Army Privatization Project C-3.
	Number of Crews	Grade Site: 2; CSA Substation construction (46kV ductline, Gravel & Paving): 2; Steel Fabrication: 1; Install Structures & Switches: 2; Install Transformer/Switchgear: 2.5; Interconnection wiring: 3; Pre-Energization Checks/Install Relay Settings: 3; Final Testing: 2	crews	Provided by developer, except "Install Transformer/Switchgear" subphase which was scaled based on the GHG analysis for Army Privatization Project C-3.
	Number of Workers per Crew	Substation crew (Grade Site, Steel Fabrication, Gravel & Paving) (3), Instrument & Control (Transformer/Switchgear and Structures & Switches) (2), Test (Final Testing) (1), Relay (Pre-Energization Checks/Install Relay Settings) (1), CSA (CSA Substation Construction) (6), Welding (Interconnection Wiring) (2), Underground (46 kV Ductline) (4)	#	Provided by developer
	Known Diesel Equipment On-Site	Grade Site: (1) Dozers with Rippers, (1) Excavators, (2) Backhoes, (2) Trenchers, (1) Honda 2000EUi Generator Steel Fabrication: (1) Honda 2000EUi Generator CSA Substation Construction: (1) Honda 2000EUi Generator 46 kV Ductline: (1) Dozers with Rippers, (1) Excavators, (2) Backhoes, (2) Trenchers, (1) Honda 2000EUi Generator Gravel and Paving: (1) Paving Equipment, (1) Honda 2000EUi Generator Structures & Switches: (1) Boom Truck, (1) Flat Bed, (1) Honda 2000EUi Generator Transformers/Switchgear: (1) Boom Truck, (1) Flat Bed, (1) Honda 2000EUi Generator Interconnection Wiring: (1) Honda 2000EUi Generator Pre-Energization Checks/Install Relay Settings: (1) Honda 2000EUi Generator Final Testing: (1) Honda 2000EUi Generator		Provided by developer
	Known Gasoline Equipment On-Site	All construction subphases: (2) Vans, (1) Pick-up Truck		Provided by developer - (1) 2008 Workhorse W31462 Crew Van, (1) 2011 Ford F250 Pickup Truck, (1) 2009 Toyota Sienna Mini Van

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Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Construction	**Known Natural Gas Equipment On-Site**	None		Provided by developer
	Size of Construction Area	0.814	acres	Provided by developer
	Average Construction Trips Per Day	6	trips/day	6 trips provided by developer.
	Average Commute Trips Per Day	2	trips/person/day	For commute trips, we will assume 2 trips (or one round trip) for each person per day unless otherwise specified. Please note one trip is one single trip, therefore two trips would be equivalent to one round trip.
	Approx. Excavated Soil	900	yd^3	Provided by developer- "Estimate based off of Ft. Shafter construction amount."
	Excavated Soil Hauled Off-Site	450	yd^3	Provided by developer- "Amount dependent on soil characterization study. Estimating able to reuse half for backfill"
	Additional Construction Details	N/A		Provided by developer
	46kV Overhead and Underground Transmission Line Construction			
	Subphases (days)	46KV construction: Conduit Installation (30 days), Manhole Installation (3 days), Pole Installation (10 days), Overhead Conductor Installation (24 days), Underground Cable Installation (8 days), Fiber Cable Installation (50 days)		Proved by developer, except "Conduit Installation", "Manhole Installation", and "Underground Cable Installation" subphases which were scaled based on the GHG analysis for Army Privatization Project C-3, "Pole Installation" subphase which was scaled based on the GHG analysis for Army Privatization Project C-7, and "Overhead Conductor Installation" subphase which was scaled based on the GHG analysis for Army Privatization Project C-1.
	Overall Construction Duration	125	days	Provided by developer and scaled based on the GHG analysis for Army Privatization Project C-1, C-3, and C-7.
	Number of Crews	Conduit Installation: 1; Manhole Installation 1; Pole Installation 2; Overhead Conductor Installation: 2; Underground Cable Installation 2; Fiber Cable Installation: 2		Provided by developer
	Number of Workers per Crew	Conduit Installation: 8; Manhole Installation 3; Pole Installation 10; Overhead Conductor Installation: 5; Underground Cable Installation 5; Fiber Cable Installation: 5		Provided by developer, except "Conduit Installation" and "Manhole Installation" subphases which were scaled based on the GHG analysis for Army Privatization Project C-3 and "Pole Installation" subphase which was scaled based on the GHG analysis for Army Privatization Project C-7.

Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Construction	**Known Diesel Equipment On-Site**	Conduit Installation (8hr/day): (1) Dozers with Rippers, (1) Excavators, (2) Backhoes, (2)Trenchers Manhole Installation (6hr/day): (1) Crane, (1) Fork Lift Pole Installation: (1) Strato-Tower, (2) Pick- up Trucks, (1) Hyliner, (1) Skagit Overhead Conductor Installation: (1) Strato-Tower, (2) Pick-up Trucks, (1) Hyliner, (1) Skagit Underground Cable Installation: (1) Trailer, (1) Hyliner, (1) Hog, (1) Truck, (2) Vans Overhead Fiber Installation: (1) Strato-Tower, (2) Pick-up Trucks, (1) Hyliner, (1) Skagit		Provided by developer
	Known Gasoline Equipment On-Site	--		Provided by developer
	Known Natural Gas Equipment On-Site	--		Provided by developer
	Size of Construction Area	8.58	acres	Provided by developer, based on 14,965 feet of conductor x 25 ft wide for positioning of equipment vehicles.
	Average Construction Trips Per Day	Conduit Installation: 6; Manhole Installation: 2; Pole Installation: 5; Overhead Conductor Installation: 5; Underground Cable Installation: 6; Overhead Fiber Installation: 5	trips/day	Provided by developer
	Average Commute Trips Per Day	2	trips/person/day	For commute trips, we will assume 2 trips (or one round trip) for each person per day unless otherwise specified. Please note one trip is one single trip, therefore two trips would be equivalent to one round trip.
	Approx. Excavated Soil	6,262	yd^3	Provided by developer
	Excavated Soil Hauled Off-Site	6,262	yd^3	Provided by developer
	Additional Construction Details	N/A		
Use	**Use**			
	Truck and Worker Trips for O&M	4	trips/yr	Quarterly maintenance trips assumption is from previous GHG Analysis projects.
	Truck and Worker Trip Distance for O&M - Commute Travel	32	miles/round-trip	Based on distance from HECO office located on Bishop street to the project site.

Table 2
Project Specific Inputs and Assumptions
Hoʻopili Substation GHG Analysis
Oʻahu, HI

	Description	Number	Unit	Reference
Global Warming Potentials	**Global Warming Potentials**			
	Carbon Dioxide	1	g CO_2e/g CO_2	Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (AR5), 2014.[18]
	Methane	28	g CO_2e/g CH_4	
	Nitrous Oxide	265	g CO_2e/g N_2O	

Abbreviations:

# - unit	hrs - hours
CalEEMod - California Emissions Estimator MODel	I/O - Input/Output
CH_4 - methane	kg - kilogram
CO_2 - carbon dioxide	kV - kilovolts
CO_2e - carbon dioxide equivalents	kVA - kilovolt-ampere
cuft - cubic feet	mi - miles
CY- cubic yards	lb - pound
ft - feet	N_2O - nitrous oxide
g - grams	yr - year

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Appendix Table A1
Raw Materials Extraction & Manufacturing Transmission Line and Distribution GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Description		Amount[1]	Units	Lifecycle GHG Emission Factor	Units	GHG Emissions (MT CO_2e)
Underground Transmission Line	Underground Transmission Line Conductor[2]	6,738	kg	8.2	kg CO_2e/kg	55
	PVC Conduits[3]	4,982	kg	2.1	kg CO_2e/kg	10.4
	Thermal Concrete[4]	178,347	kg	0.09	kg CO_2e/kg	16.2
	Fluidized Thermal Backfill[4]	491,180	kg	0.09	kg CO_2e/kg	45
	Concrete Manholes[4]	139,708	kg	0.09	kg CO_2e/kg	13
	Manhole Covers[5]	789	kg	4.8	kg CO_2e/kg	3.8
Overhead Transmission Line	Overhead Transmission Line Conductor[2]	9,866	kg	8.2	kg CO_2e/kg	81
Fiber Optic Cables	Fiber Optic Cable[6]	4,494	kg	2.3	kg CO_2e/kg	10.3
Utility Poles	Wood Utility Poles[7]	82,814	kg	0.11	kg CO_2e/kg	8.8
	Steel Utility Poles[6]	24,000	kg	4.8	kg CO_2e/kg	115
	Steel Utility Poles - Concrete Foundation[4]	4,899	kg	0.09	kg CO_2e/kg	0.45

Appendix Table A1
Raw Materials Extraction & Manufacturing Transmission Line and Distribution GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Description		Amount[1]	Units	Lifecycle GHG Emission Factor	Units	GHG Emissions (MT CO_2e)
Misc. Equipment	Switchgears[8]	5,896	kg	4.2	kg CO_2e/kg	25
	Switchgear Concrete Pad[4]	20,725	kg	0.09	kg CO_2e/kg	1.9
	Transformers[9]	1	#	77	MT CO_2e/item	77
	12kV Splices[10]	5.4	kg	2.8	kg CO_2e/kg	0.02
	46kV Splices[10]	53	kg	2.8	kg CO_2e/kg	0.15
	Light Fixtures[11]	85	kg	289	kg CO_2e/kg	25
	Lightning Arrestors[12]	90	kg	9.0	kg CO_2e/kg	0.81
	Fuse and Fuse Mount on Transformer[6]	312	kg	4.8	kg CO_2e/kg	1.5
	Distributed Discrete I/O Module[13]	5.4	kg	335	kg CO2e/kg	1.8
	Remote Terminal Unit[13]	4.3	kg	335	kg CO2e/kg	1.4
	Battery[14]	368	kg	2.3	kg CO2e/kg	0.9
	Battery Cabinet[6]	544	kg	4.8	kg CO_2e/kg	2.6
	Battery Charger[15]	55	kg	29	kg CO_2e/kg	1.6
Proposed Substation Materials	Circuit Breakers[16]	318	kg	4.9	kg CO_2e/kg	1.5
	Substation[17]	1	#	81	MT CO_2e/item	81
					Total	**580**

Appendix Table A1
Raw Materials Extraction & Manufacturing Transmission Line and Distribution GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Notes:

1. Project specifications, assumptions and references are provided in Table 2.
2. The GHG emissions factor for overhead and underground transmission lines and aluminum conductors is an estimate from Jorge, et al. (2011a) estimated emissions for a 150 kV overhead transmission line (Figure 1a), scaled based on the weight of the transmission line. The estimated emissions for an overhead transmission line are used because the transmission line material for this Project is of similar material to that of the overhead transmission line from Jorge, et al. (2011a). This factor represents total CO_2e emissions per kg of transmission line for components such as conductors, insulators, installation, and usage. Installation and usage together account for less than approximately 4% of total emissions, so these are conservatively included in addition to the Construction and Use Phase emissions estimated in Tables A3 and A4, respectively.
3. The GHG emissions factor for PVC conduit is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., polyvinylchloride production, bulk polymerization, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.5.
4. The GHG emissions factor for Thermal Concrete, Fluidized Thermal Backfill, concrete manholes, switchgear concrete pad, and steel utility poles - concrete foundation is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Martineau, G., concrete production 20MPa, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.
5. The GHG emissions factor for manhole covers, steel utility poles, fuse and fuse mount, and battery cabinet is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Classen, M., steel production, chromium steel 18/8, hot rolled, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.
6. The GHG emissions factor for the fiber optic cable is an estimate from J.T.M. Pinto et al. (2017) cradle-to-gate emissions for the fiber optic cable "Business As Usual (BAU) Scenario 1" as provided in Table 11. The cable modeled as BAU was chosen because the materials for this cable are similar to the Project's fiber optic cable. Additionally, Scenario 1 was chosen because it is the most conservative as cradle-to-gate emissions are modeling using natural gas and coal as energy sources. The emission factor for BAU Scenario 1 was normalized based on BAU Scenario 3's Cable Weight as determined by information provided in Table 11 and Figure 6.
7. The GHG emissions factor for the wood utility poles is estimated from Bolin and Smith, 2011 (Table 2). This factor represents total CO_2e emissions per utility pole for the pole production and treating life cycle stages. As defined by Bolin and Smith, 2011, pole production for the wood pole includes: "replanting a harvested area of forest, growing and maintaining the forest plantation until harvest, harvesting of the trees, drying, and milling and associated transportation" and treating includes: "pole peeling, pole drying, preservative manufacture and transport, treatment, storage of untreated and treated poles, releases, and transportation of poles to the utility yard". The estimated emissions from Bolin and Smith were conservatively scaled based on the weight of each pole.
8. The GHG emissions factor for the switchgears is estimated from Jorge, et al., 2011b (Figure 2). These factors represent the CO_2e emissions per item associated with raw material extraction and production for the switchgears. The emissions factor for the switchgears is based on the emission factor for the Medium Voltage Switchgear from Jorge et al., 2011b normalized based on weight, provided in Table S18 of Jorge, et al., 2011b.
9. The GHG emissions factor for a transformer is estimated from Jorge, et al. (2011b, Figure 1). These factors represent the CO_2e emissions per item associated with raw material extraction and production for the transformer. Jorge et al., 2011b estimated emissions from transformers of ratings between 0.35 to 500 MVA; the emission factor for the Project's 10/12.5 MVA transformer was calculated based on the emissions per transformer rating for the Jorge transformer with the closest rating (using geometric mean) to the Project's 10/12.5 MVA transformer, scaled to the Project's 10/12.5 MVA rating.
10. The GHG emissions factor for 12kv and 46kv splices is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., synthetic rubber production, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.

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Appendix Table A1
Raw Materials Extraction & Manufacturing Transmission Line and Distribution GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

11. The GHG emissions factor for lights is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., light emitting diode production, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), Allocation, cut-off by classification, ecoinvent database version 3.5. Emissions from the lights conservatively assume the high end of manufacturer's weight and treat the entire weight as the weight of an LED light bulb instead of calculating emissions separately from the fixture material and from the LED light bulb.

12. The GHG emissions factor for the lightning arrestors is estimated from Jorge, et al., 2011b (Table 4). This factor represents the CO_2e emissions per item associated with raw materials production, power losses and end of life for the surge arrestor. The emission factor for the Project's lightning arrestors was estimated based on the emissions per surge arrestor from Jorge, normalized by weight.

13. The GHG emissions factor for the Distributed Discrete I/O Module and Remote Terminal Units is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., production of printed wiring board, surface mounted, unspecified, Pb free, GLO, Allocation, cut-off by classification, ecoinvent database version 3.5.

14. The GHG emission factor for the lead calcium battery is derived from the results of the Peters, et al. literature review of stationary battery storage technologies, which references a 2017 carbon footprint of stationary grid applications from Baumann et al. The Baumann study provides the emission factor for a valve regulated lead acid (VRLA) battery composition, which is similar to the Project's lead-calcium battery composition; this emission factor was used to calculate the emissions of the raw materials extraction and manufacturing for the Project's batteries. According to Wang et al., the LCIs of a lead-acid battery and a lead-calcium battery are considered to be reasonably similar, as the composition of calcium in lead-calcium alloy battery is usually less than 0.1% by weight for anti-corrosion purposes.

15. The GHG emissions factor for the battery charger is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Habermacher, F., charger production, for electric passenger car, GLO, Allocation, cut-off by classification, ecoinvent database version 3.5.

16. The GHG emissions factor for the circuit breakers is estimated from Jorge, et al., 2011b (Figure 2b). These factors represent the CO_2e emissions per item associated with raw material extraction and production for the circuit breakers. The emissions factor for the circuit breakers is based on the emission factor for the Live Tank Circuit Breaker (LTCB) from Jorge et al., 2011b normalized based on weight, provided in Table S16 of Jorge, et al., 2011b.

17. The GHG emission factor for the substation is estimated from Harrison, et al., 2010 (Table 2 and Table 5). This factor represents the CO_2e emissions associated with raw materials extraction and production. Harrison, et al. estimated emissions for five substation bays (concrete foundations, steelwork, and aluminum) and for basic civil engineering (concrete, limestone chipping, and fencing) for a substation with an approximate area of 20,000 m^2. The material amounts and estimated emissions from Harrison, et al. for circuit breakers were multiplied by the number of breakers for the Ho'opili Substation. The material amounts and estimated emissions from Harrison, et al. for the five substation bays were used for the Ho'opili Substation. The material amounts and estimated emissions from Harrison, et al. for basic civil engineering were scaled based on the approximate area of the Ho'opili Substation.

Appendix Table A1
Raw Materials Extraction & Manufacturing Transmission Line and Distribution GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Abbreviations:

# - number	IPCC - Intergovernmental Panel on Climate Change
CO_2e - carbon dioxide equivalence	kg - kilogram
GHG - greenhouse gas	MT - metric ton
GLO - global	MVA - megavolt-ampere
GWP - global warming potentials	MPa - megapascal
I/O - Input/Output	PVC - Poly Vinyl Chloride
	RoW - rest of world

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Hischier, R., printed wiring board, surface mounted, unspecified, Pb free, GLO, Allocation, cut-off by classification, ecoinvent database version 3.5.

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Appendix Table A2
Material Transportation GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Mode of Travel	Emission Factors[1] (kg/ton-mi) CO_2	(kg/ton-mi) CH_4	(kg/ton-mi) N_2O	(kg/MT-km) CO_2e
Trucks	0.20	2.0E-06	1.5E-06	0.14
Ship	--	--	--	0.0083

Project Stage	Shipment Item	Weight (kg)	Total Items	Net Weight (MT)[2]	Phase	Origin	Destination	Mode[3]	Trip length (mi or nmi)[4]	GHG Emissions ($MT\ CO_2e$) Per Segment	GHG Emissions ($MT\ CO_2e$) Per Item
Proposed Underground Transmission Line	Underground Transmission Line Conductor	6,738	1	6.7	Upstream	South Carolina (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,350	3.5	3.8
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.23	
						Honolulu (Port)	Site	Trucks	16	0.02	
	Thermal Concrete - British Columbia	36,843	1	37	Upstream	British Columbia (Manufacturer/Warehouse)	Victoria (Port)	Trucks	288	2.4	4.4
						Victoria (Port)	Los Angeles (Port)	Ship	1,081	0.61	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	1.3	
						Honolulu (Port)	Site	Trucks	16	0.13	
	Fluidized Thermal Backfill (FTB) - British Columbia	121,423	1	121	Upstream	British Columbia (Manufacturer/Warehouse)	Victoria (Port)	Trucks	288	7.8	14
						Victoria (Port)	Los Angeles (Port)	Ship	1,081	2.0	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	4.2	
						Honolulu (Port)	Site	Trucks	16	0.43	
	Thermal Concrete - Hawaii	141,504	1	142	Upstream	Hawaii (Manufacturer/Warehouse)	Site	Trucks	10	0.32	0.32
	Fluidized Thermal Backfill (FTB) - Hawaii	369,758	1	370	Upstream	Hawaii (Manufacturer/Warehouse)	Site	Trucks	10	0.83	0.83
	Conduit Duct (PVC)	4,982	1	5.0	Upstream	Millford, Utah (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	510	0.57	0.76
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.17	
						Honolulu (Port)	Site	Trucks	16	0.02	
Proposed Underground Transmission Line	Manholes and Manhole Covers	23,416	6	140	Upstream	Hawaii (Manufacturer/Warehouse)	Site	Trucks	10	0.31	0.31
					Downstream	Site	Honolulu (Port)	Trucks	16	0.50	6.1
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	4.8	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.78	

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Appendix Table A2
Material Transportation GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Project Stage	Shipment Item	Weight (kg)	Total Items	Net Weight (MT)[2]	Phase	Origin	Destination	Mode[3]	Trip length (mi or nmi)[4]	GHG Emissions (MT CO_2e)	
										Per Segment	Per Item
Proposed Overhead Transmission Line	Overhead Transmission Line Conductor	4,933	2	9.9	Upstream	Florence, Alabama (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,013	4.4	4.8
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.34	
						Honolulu (Port)	Site	Trucks	16	0.04	
					Downstream	Site	Honolulu (Port)	Trucks	16	0.04	0.43
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.34	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.06	
Fiber Optic Cable	Fiber Optic Cable	1,124	4	4.5	Upstream	Duncan, South Carolina (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,391	2.4	2.6
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.15	
						Honolulu (Port)	Site	Trucks	16	0.02	
					Downstream	Site	Honolulu (Port)	Trucks	16	0.02	0.20
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.15	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.03	
Utility Poles	Steel Poles	2,000	12	24.0	Upstream	Omaha, Nebraska (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	1,686	9.0	9.9
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.82	
						Honolulu (Port)	Site	Trucks	16	0.09	
					Downstream	Site	Honolulu (Port)	Trucks	16	0.09	1.0
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.82	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.13	
	Steel Pole Concrete Foundation - British Columbia	337	3	1.0	Upstream	British Columbia (Manufacturer/Warehouse)	Victoria (Port)	Trucks	288	0.07	0.12
						Victoria (Port)	Los Angeles (Port)	Ship	1,081	0.02	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.03	
						Honolulu (Port)	Site	Trucks	16	3.6E-03	

Appendix Table A2
Material Transportation GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Project Stage	Shipment Item	Weight (kg)	Total Items	Net Weight (MT)[2]	Phase	Origin	Destination	Mode[3]	Trip length (mi or nmi)[4]	GHG Emissions ($MT\ CO_2e$) Per Segment	GHG Emissions ($MT\ CO_2e$) Per Item
Utility Poles	Steel Pole Concrete Foundation - Hawaii	1,296	3	3.9	Upstream	Hawaii (Manufacturer/Warehouse)	Site	Trucks	10	8.7E-03	8.7E-03
	Wood Poles	1,358	61	82.8	Upstream	Washington (Manufacturer/Warehouse)	Tacoma (Port)	Trucks	5.0	0.09	4.7
						Tacoma (Port)	Los Angeles (Port)	Ship	1,165	1.5	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	2.8	
						Honolulu (Port)	Site	Trucks	16	0.30	
					Downstream	Site	Honolulu (Port)	Trucks	16	0.30	3.6
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	2.8	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.46	
Miscellanous Proposed Project Equipment	Switchgears	5,896	1	5.9	Upstream	Omaha, Nebraska (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	1,686	2.2	2.4
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.20	
						Honolulu (Port)	Site	Trucks	16	0.02	
					Downstream	Site	Honolulu (Port)	Trucks	16	0.02	0.26
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.20	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.03	
	Switchgear Concrete Pad - British Columbia	4,281	1	4.3	Upstream	British Columbia (Manufacturer/Warehouse)	Victoria (Port)	Trucks	288	0.28	0.51
						Victoria (Port)	Los Angeles (Port)	Ship	1,081	0.07	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.15	
						Honolulu (Port)	Site	Trucks	16	0.02	
	Switchgear Concrete Pad - Hawaii	16,443	1	16.4	Upstream	Hawaii (Manufacturer/Warehouse)	Site	Trucks	10	0.04	0.04
	Transformers	38,130	1	38.1	Upstream	South Boston, Virginia (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,537	22	23
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	1.3	
						Honolulu (Port)	Site	Trucks	16	0.14	
					Downstream	Site	Honolulu (Port)	Trucks	16	0.14	1.7
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	1.3	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.21	

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Appendix Table A2
Material Transportation GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Project Stage	Shipment Item	Weight (kg)	Total Items	Net Weight (MT)[2]	Phase	Origin	Destination	Mode[3]	Trip length (mi or nmi)[4]	GHG Emissions ($MT\ CO_2e$) Per Segment	GHG Emissions ($MT\ CO_2e$) Per Item
Miscellanous Proposed Project Equipment	Batteries	46	8	0.37	Upstream	Mexico (Manufacturer/Warehouse)	Mexico (Port)	Trucks	715	0.06	0.08
						Mexico (Port)	Los Angeles (Port)	Ship	1,006	5.7E-03	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.01	
						Honolulu (Port)	Site	Trucks	16	1.3E-03	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.3E-03	0.02
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.01	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	2.1E-03	
	Battery Charger	55	1	0.06	Upstream	Easton, Pennsylvania (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,761	0.34	0.36
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.02	
						Honolulu (Port)	Site	Trucks	16	1.9E-03	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.9E-03	0.02
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.02	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	3.0E-03	
	Battery Cabinet	544	1	0.54	Upstream	Omaha, Nebraska (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	1,686	0.20	0.23
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.02	
						Honolulu (Port)	Site	Trucks	16	1.9E-03	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.9E-03	0.02
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.02	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	3.0E-03	

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Appendix Table A2
Material Transportation GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Project Stage	Shipment Item	Weight (kg)	Total Items	Net Weight (MT)[2]	Phase	Origin	Destination	Mode[3]	Trip length (mi or nmi)[4]	GHG Emissions ($MT\ CO_2e$) Per Segment	GHG Emissions ($MT\ CO_2e$) Per Item
Miscellanous Proposed Project Equipment	Lightning Arrestors	15	6	0.09	Upstream	Mt. Pleasant, Pennsylvania (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,464	0.05	0.05
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	3.1E-03	
						Honolulu (Port)	Site	Trucks	16	3.2E-04	
					Downstream	Site	Honolulu (Port)	Trucks	16	3.2E-04	3.9E-03
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	3.1E-03	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	5.0E-04	
	Distributed Discrete I/O (DDIO) Control Device	1.4	4	5.4E-03	Upstream	Lenexa, Kansas (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	1,630	2.0E-03	2.2E-03
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	1.9E-04	
						Honolulu (Port)	Site	Trucks	16	1.9E-05	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.9E-05	2.3E-04
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	1.9E-04	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	3.0E-05	
	Remote Terminal Unit	4.3	1	4.3E-03	Upstream	Lenexa, Kansas (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	1,630	1.6E-03	1.7E-03
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	1.5E-04	
						Honolulu (Port)	Site	Trucks	16	1.5E-05	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.5E-05	1.9E-04
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	1.5E-04	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	2.4E-05	
	Fuse and Fuse Mount on Transformer	312	3	0.9	Upstream	Chicago, Illinois (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,038	0.43	0.46
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.03	
						Honolulu (Port)	Site	Trucks	16	3.3E-03	
					Downstream	Site	Honolulu (Port)	Trucks	16	3.3E-03	0.04
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.03	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	5.2E-03	

Appendix Table A2
Material Transportation GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Project Stage	Shipment Item	Weight (kg)	Total Items	Net Weight (MT)[2]	Phase	Origin	Destination	Mode[3]	Trip length (mi or nmi)[4]	GHG Emissions (MT CO_2e) Per Segment	GHG Emissions (MT CO_2e) Per Item
Miscellanous Proposed Project Equipment	12kV Splices	0.45	12	5.4E-03	Upstream	Memphis, Tennessee (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	1,832	2.2E-03	2.4E-03
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	1.9E-04	
						Honolulu (Port)	Site	Trucks	16	1.9E-05	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.9E-05	2.4E-04
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	1.9E-04	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	3.0E-05	
	46kV Splices	1.8	30	5.3E-02	Upstream	Wilsonville, Oregon (Manufacturing/Warehouse)	Los Angeles (Port)	Trucks	973	0.01	0.01
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	1.8E-03	
						Honolulu (Port)	Site	Trucks	16	1.9E-04	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.9E-04	2.3E-03
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	1.8E-03	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	3.0E-04	
	Light Fixtures	17	5	8.5E-02	Upstream	Durham, North Carolina (Manufacturer/Warehouse)	Los Angeles (Port)	Trucks	2,545	0.05	0.05
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	2.9E-03	
						Honolulu (Port)	Site	Trucks	16	3.0E-04	
					Downstream	Site	Honolulu (Port)	Trucks	16	3.0E-04	3.7E-03
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	2.9E-03	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	4.7E-04	

Appendix Table A2
Material Transportation GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Project Stage	Shipment Item	Weight (kg)	Total Items	Net Weight (MT)[2]	Phase	Origin	Destination	Mode[3]	Trip length (mi or nmi)[4]	GHG Emissions ($MT\ CO_2e$) Per Segment	Per Item
Proposed Substation Materials	Circuit Breakers	159	2	0.3	Upstream	Abercido, Puerto Rico (Manufacturer/Warehouse)	Puerto Rico (Port)	Trucks	44	3.1E-03	0.03
						Puerto Rico (Port)	Los Angeles (Port)	Ship	3,943	0.02	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	0.01	
						Honolulu (Port)	Site	Trucks	16	1.1E-03	
					Downstream	Site	Honolulu (Port)	Trucks	16	1.1E-03	0.01
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.01	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	1.8E-03	
	Basic Engineering & Substation Bay Materials - British Columbia	264,775	1	264.8	Upstream	British Columbia (Manufacturer/Warehouse)	Victoria (Port)	Trucks	288	17	31
						Victoria (Port)	Los Angeles (Port)	Ship	1,081	4.4	
						Los Angeles (Port)	Honolulu (Port)	Ship	2,231	9.1	
						Honolulu (Port)	Site	Trucks	16	0.95	
	Basic Engineering & Substation Bay Materials - Hawaii	1,016,925	1	1,016.9	Upstream	Hawaii (Manufacturer/Warehouse)	Site	Trucks	10	2.3	2.3
	Substation - Bulk of System[5]	10,440	1	10.4	Downstream	Site	Honolulu (Port)	Trucks	16	0.04	0.45
						Honolulu (Port)	Los Angeles (Port)	Ship	2,231	0.36	
						Los Angeles (Port)	Los Angeles (Scrap Yard)	Trucks	25	0.06	
Total GHG Emissions ($MT\ CO_2e$) - Upstream											**108**
Total GHG Emissions ($MT\ CO_2e$) - Downstream											**14**
Total GHG Emissions ($MT\ CO_2e$)											**122**

Appendix Table A2
Material Transportation GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Notes:

1. Emission factors for road transportation are taken from US EPA Scope 3 Inventory Guidance. The shipping emission factor is based on the average of Global Maritime Emission Factor for dry (non-refrigerated cargo) and refrigerated cargo emissions factors over all trade lanes for 2013 assuming an average load weight of 10 tons in each container, as implemented in CN's Carbon Calculator.

2. The net weight is determined based on the weight of each part and the quantity of each part.

3. For a given transportation segment, if the mode of travel is not known and if multiple travel modes are available, the most emissions-intensive mode is selected.

4. The trip lengths for each leg of travel were estimated based on the following assumptions:
   (a) Shipping distances were estimated using the Sea Distance tool, available at https://sea-distances.org.
   (b) Truck distances were estimated by using Google Maps to determine driving distances between the location of the Port and the furthest point in the jurisdiction.

5. Substation - Bulk of System is the total weight of all aluminum and steel associated with the Basic Civil Engineering & Substation Bay Materials that will be installed for the project. Concrete is not included in this total as it is assumed no concrete will be removed from site.

Abbreviations:

CH_4 - methane	kg - kilogram
CN - Canadian National	km - kilometer
CO_2 - carbon dioxide	mi - mile
CO_2e - carbon dioxide equivalent	MT - Metric Tons
GHG - Greenhouse Gas	nmi - nautical mile
GWP - global warming potential	N_2O - nitrous oxide

References:

CN Carbon Calculator. Available at: https://www.cn.ca/en/delivering-responsibly/environment/emissions/carbon-calculator/

EPA (2018). Emission Factors for Greenhouse Gas Inventories. March 9. Available at: https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf

Global Maritime Emission Factors. Available at: https://www.bsr.org/en/our-insights/rePort-view/global-maritime-trade-lane-emissions-factors.

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Appendix Table A3
Construction GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Installation of Substation Equipment:

Construction Schedule[1]			
Construction Phase	**Construction Subphase**	**Number of Workers**	**Days**
Substation Construction	Grade Site	6	40
	Steel Fabrication	3	40
	CSA Substation Construction	12	50
	46 kV Ductline	8	2
	Gravel and Paving	6	5
	Structures & Switches	4	40
	Transformer/Switchgear	5	10
	Interconnection Wiring	6	40
	Pre-Energization Checks/Install Relay Settings	3	25
	Final Testing	2	20
Overhead and Underground Transmission Line Construction	Conduit Installation	8	30
	Manhole Installation	3	3
	Pole Installation	20	10
	Overhead Conductor Installation	10	24
	Underground Cable Installation	10	8
	Fiber Cable Installation	10	50

Installation Offroad Emissions:

Construction Subphase	Equipment Type[1]	Quantity[1]	Avg. Usage Hours per Day	Utilization Rate	Hours of Operation (hr/ project)	Horsepower[2]	Load[2]	EF (g/bhp-hr)[3]			GHG Emissions[4] (MT CO_2e)
								CO_2	CH_4	CO_2e	
Grade Site	Dozers with Rippers	1	8	0.75	240	247	0.40	475	0.2	479	11
	Excavators	1	8	0.75	240	158	0.38	472	0.2	477	7
	Backhoes	2	8	0.75	480	97	0.37	475	0.2	480	8
	Trenchers	2	8	0.75	480	78	0.50	475	0.2	480	9
	Vans	2	8	0.75	480	402	0.38	475	0.2	479	35
	Pick-up Truck	1	8	0.75	240	402	0.38	475	0.2	479	18
	Honda 2000EUi Generator	1	8	0.75	240	84	0.74	568	0.0	569	8
Steel Fabrication	Vans	2	8	0.75	480	402	0.38	475	0.2	479	35
	Pick-up Truck	1	8	0.75	240	402	0.38	475	0.2	479	18
	Honda 2000EUi Generator	1	8	0.75	240	84	0.74	568	0.0	569	8
CSA Substation Construction	Vans	2	8	0.75	600	402	0.38	475	0.2	479	43.9
	Pick-up Truck	1	8	0.75	300	402	0.38	475	0.2	479	21.9
	Honda 2000EUi Generator	1	8	0.75	300	84	0.74	568	0.0	569	10.6
46 kV Ductline	Dozers with Rippers	1	8	0.75	12	247	0.40	475	0.2	479	0.6
	Excavators	1	8	0.75	12	158	0.38	472	0.2	477	0.3
	Backhoes	2	8	0.75	24	97	0.37	475	0.2	480	0.4
	Trenchers	2	8	0.75	24	78	0.50	475	0.2	480	0.4
	Vans	2	8	0.75	24	402	0.38	475	0.2	479	1.8
	Pick-up Truck	1	8	0.75	12	402	0.38	475	0.2	479	0.9
	Honda 2000EUi Generator	1	8	0.75	12	84	0.74	568	0.0	569	0.4
Gravel and Paving	Paving Equipment	1	8	0.75	30	132	0.36	471	0.2	475	0.7
	Vans	2	8	0.75	60	402	0.38	475	0.2	479	4.4
	Pick-up Truck	1	8	0.75	30	402	0.38	475	0.2	479	2.2
	Honda 2000EUi Generator	1	8	0.80	32	84	0.74	568	0.0	569	1.1

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Appendix Table A3
Construction GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Construction Subphase	Equipment Type[1]	Quantity[1]	Avg. Usage Hours per Day	Utilization Rate	Hours of Operation (hr/ project)	Horsepower[2]	Load[2]	EF (g/bhp-hr)[3]			GHG Emissions[4] (MT CO_2e)
								CO_2	CH_4	CO_2e	
Structures & Switches	Vans	2	8	0.75	480	402	0.38	475	0.2	479	35
	Boom Truck	1	8	0.75	240	402	0.38	475	0.2	479	18
	Flat Bed	1	8	0.75	240	402	0.38	475	0.2	479	18
	Pick-up Truck	1	8	0.75	240	402	0.38	475	0.2	479	18
	Honda 2000EUi Generator	1	8	0.75	240	84	0.74	568	0.0	569	8
Transformer/Switchgear	Vans	2	8	0.75	120	402	0.38	475	0.2	479	9
	Boom Truck	1	8	0.75	60	402	0.38	475	0.2	479	4.4
	Flat Bed	1	8	0.75	60	402	0.38	475	0.2	479	4.4
	Pick-up Truck	1	8	0.75	60	402	0.38	475	0.2	479	4.4
	Honda 2000EUi Generator	1	8	0.75	60	84	0.74	568	0.0	569	2.1
Interconnection Wiring	Vans	2	8	0.75	480	402	0.38	475	0.2	479	35
	Pick-up Truck	1	8	0.75	240	402	0.38	475	0.2	479	18
	Honda 2000EUi Generator	1	8	0.75	240	84	0.74	568	0.0	569	8
Pre-Energization Checks/Install Relay Settings	Vans	2	8	0.75	300	402	0.38	475	0.2	479	22
	Pick-up Truck	1	8	0.75	150	402	0.38	475	0.2	479	11
	Honda 2000EUi Generator	1	8	0.75	150	84	0.74	568	0.0	569	5
Final Testing	Vans	2	8	0.75	240	402	0.38	475	0.2	479	18
	Pick-up Truck	1	8	0.75	120	402	0.38	475	0.2	479	9
	Honda 2000EUi Generator	1	8	0.75	120	84	0.74	568	0.0	569	4.2
Total Substation Construction Offroad Emissions											**498**
Conduit Installation	Dozers with Rippers	1	8	0.75	180	247	0.40	475	0.2	479	9
	Excavators	1	8	0.75	180	158	0.38	472	0.2	477	5
	Backhoes	2	8	0.75	360	97	0.37	475	0.2	480	6
	Trenchers	2	8	0.75	360	78	0.50	475	0.2	480	7
Manhole Installation	Crane	1	6	0.75	14	231	0.29	473	0.2	477	0.4
	Forklift	1	6	0.75	14	89	0.20	472	0.2	476	0.1
Pole Installation	Strato-Tower	1	8	0.75	60	402	0.38	475	0.2	479	4.4
	Pick-up Truck	2	8	0.75	120	402	0.38	475	0.2	479	9
	Hyliner	1	8	0.75	60	231	0.29	473	0.2	477	1.9
	Skagit	1	8	0.75	60	172	0.42	470	0.2	474	2.1
Overhead Conductor Installation	Strato-Tower	1	8	0.75	147	402	0.38	475	0.2	479	11
	Pick-up Truck	2	8	0.75	294	402	0.38	475	0.2	479	21
	Hyliner	1	8	0.75	147	231	0.29	473	0.2	477	4.7
	Skagit	1	8	0.75	147	172	0.42	470	0.2	474	5
Underground Cable Installation	Trailer	1	8	0.75	47	402	0.38	475	0.2	479	3.4
	Hyliner	1	8	0.75	47	231	0.29	473	0.2	477	1.5
	Hog	1	8	0.75	47	9	0.56	568	0.1	570	0.1
	Truck	1	8	0.75	47	402	0.38	475	0.2	479	3.4
	Vans	2	8	0.75	93	402	0.38	475	0.2	479	7
Fiber Cable Installation	Strato-Tower	1	8	0.75	300	402	0.38	475	0.2	479	22
	Pick-up Truck	2	8	0.75	600	402	0.38	475	0.2	479	44
	Hyliner	1	8	0.75	300	231	0.29	473	0.2	477	10
	Skagit	1	8	0.75	300	172	0.42	470	0.2	474	10
Total Overhead and Underground Transmission Line Construction Offroad Emissions											**187**
Total Construction Offroad Emissions											**685**

Appendix Table A3
Construction GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Installation Onroad Emissions:

Construction Phase	Construction Subphase	Trip Rates (trips/day)		Trip Length (mi/trip)		CO_2e Hauling EF[7]		CO_2e Worker EF[7]		GHG Emissions[8] ($MT\ CO_2e$)
		Worker[5]	Hauling[6]	Worker[5]	Hauling[6]	(g/trip)	(g/mi)	(g/trip)	(g/mi)	
Substation Construction	Grade Site	12	1.5	17	20	304	732	70	295	3.3
	Steel Fabrication	6	0	17	0	304	732	70	295	1.2
	CSA Substation Construction	24	0	17	0	304	732	70	295	6.0
	46 kV Ductline	16	0	17	0	304	732	70	295	0.2
	Gravel and Paving	12	0	17	0	304	732	70	295	0.3
	Structures & Switches	8	0	17	0	304	732	70	295	1.6
	Transformer/Switchgear	10	0	17	0	304	732	70	295	0.5
	Interconnection Wiring	12	0	17	0	304	732	70	295	2.4
	Energization Checks/Install Relay Sett	6	0	17	0	304	732	70	295	0.8
	Final Testing	4	0	17	0	304	732	70	295	0.4
Total Substation Construction Onroad Emissions										**17**
Overhead and Underground Transmission Line Construction	Conduit Installation	16	26	17	20	304	732	70	295	14
	Manhole Installation	6	0	17	0	304	732	70	295	0.1
	Pole Installation	40	0	17	0	304	732	70	295	2.0
	Overhead Conductor Installation	20	0	17	0	304	732	70	295	2.5
	Underground Cable Installation	20	0	17	0	304	732	70	295	0.8
	Fiber Cable Installation	20	0	17	0	304	732	70	295	5.0
Total Overhead and Underground Transmission Line Construction Onroad Emissions										**24**
Total Onroad Emissions										**41**

Notes:

1. Project specifications, assumptions and references are provided in Table 2.
2. Unless specifically provided by the developer, horsepower and load factor were assumed to be consistent with CalEEMod® 2016.3.2., default assumptions.
3. Emission factors associated with offroad equipment are from ARB OFFROAD2011. OFFROAD2017 is the latest version of the ARB in-use off-road equipment model. However, as the current version of CalEEMod still uses the OFFROAD2011 emission factors, this analysis also used emission factors from OFFROAD2011. Emission factors are for calendar year 2021. The OFFROAD database does not contain emission factors for N_2O emissions, which are expected to be minimal compared to overall offroad GHG emissions.
4. Offroad GHG emissions are calculated using a g/bhp-hr emission factor. This emission factor is multiplied by the hours of operation, horsepower, and load for each piece of equipment, then converted from grams to metric tons.
5. The number of home-to-work trips per day associated with each construction subphase activity was determined by multiplying the number of workers by two. The worker trip length is estimated based on the CalEEMod statewide default assumption of 16.8 miles for a home-to-work trip.
6. According to communication with the developer, approximately 450 cubic yards of excavated soil will be hauled offsite during Substation Construction and approximately 6,262 cubic yards of excavated soil will be hauled offsite during Overhead and Underground Transmission Line Construction. The number of hauling trips per day are estimated based on the CalEEMod default assumption that hauling trucks can carry 16 cubic yards of material. The hauling trip length is estimated based on the CalEEMod default assumption of 20 miles for a one-way haul trip.
7. Emission factors associated with onroad vehicles are from EMFAC2017 for calendar year 2021.
8. Onroad GHG emissions are calculated using g/trip and g/mi emission factors. The g/trip emission factors are multiplied by the trips per day, and the g/mi emission factors are multiplied by the miles per trip and trips per day. These emission rates are then multiplied by the number of days in each subphase, and converted from grams to metric tons.

Abbreviations:

ARB - California Air Resources Board	g - gram
bhp - brake horsepower	GHG - greenhouse gas
CalEEMod - California Emissions Estimator MODel	hr - hour
CH_4 - methane	kg - kilogram
CO_2 - carbon dioxide	mi - mile
CO_2e - carbon dioxide equivalent	MT - Metric Tons
EF - emissions factor	N_2O - nitrous oxide

References:

Based on CalEEMod User's Guide, Appendix D, Table 3.3. Available at: http://www.caleemod.com/.

California Air Resources Board (ARB) 2011. OFFROAD 2011. Available at: https://ww3.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

Intergovernmental Panel on Climate Change (IPCC), Fifth Assessment Report (AR5), 2014.

Appendix Table A4
Operational GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Inputs:

Source[1]	Input	Value	Units
Mobile (Trucks and Workers)[2]	Annual Truck Trips	4	trips/yr
	Truck Trip VMT - Commute Travel	32	mi/trip

Emission Factors:

Source	Details	CO_2	CH_4	N_2O	Units
Truck Trips (including commuting trips)[3]	LHDT1	728	0.009	0.048	g/mi
		19	0.018	0.022	g/trip

Greenhouse Gas Emissions:

Emission Source	Subcategory	Emissions (MT/yr)			
		CO_2	CH_4	N_2O	CO_2e
Mobile Emissions	Truck Trip VMT - Commute Travel	0.093	1.24E-06	6.27E-06	0.09
				Years of Operation	55
				Total Emissions Over Lifetime	**5.2**

Appendix Table A4
Operational GHG Emissions Calculations
Hoʻopili Substation GHG Analysis
Oʻahu, HI

Notes:

1. Project specifications, assumptions and references are provided in Table 2. There is no landscaping associated with the Project.

2. Mobile truck trips represent small trucks that drive to the transmission line to perform routine operations and management procedures (commute travel). The Project will have approximately 4 truck trips per year and the total distance traveled per trip is roughly 32 miles, the approximate roundtrip distance from HECO office located on Bishop street to the Project site.

3. Mobile emission factors are from California's EMFAC2017 database. Emission factors were estimated by averaging statewide emission factors in 2022 for LHDT1 vehicles.

References:

California Emissions Estimator Model (CalEEMod®) v2016.3.2 Appendix D. Available at: http://www.aqmd.gov/docs/default-source/caleemod/05_appendix-d2016-3-2.pdf?sfvrsn=4.

eGRID 2016 Summary Tables. Available at: https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf.

Abbreviations:

CalEEMod - California Emissions Estimator Model
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
EMFAC - Emissions FACtor model
g - grams
GWP - global warming potential
LHDT1 - light heavy duty truck
mi - miles
MT - Metric Tons
N_2O - nitrous oxide
VMT - vehicle miles traveled
yr - year

Appendix Table A5
Decommissioning & Disposal GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Stages	Components	Amount[1]	Units	Lifecycle GHG Emission Factor[2,3,4,5,6,7,8,9]	Units	GHG Emissions (MT CO_2e)
Disposal	Overhead Transmission Line Conductor	9,866	kg	0.015	kg CO_2e/kg disposed	0.14
	Fiber Optic Cable	4,494	kg	0.32	kg CO_2e/kg disposed	1.45
	Manholes	139,708	kg	0.01	kg CO_2e/kg disposed	0.74
	Manhole Covers	789	kg	0.01	kg CO_2e/kg disposed	0.004
	Switchgears	5,896	kg	0.32	kg CO_2e/kg disposed	1.91
	Transformers	38,130	kg	0.32	kg CO_2e/kg disposed	12
	Wooden Utility Poles	82,814	kg	0.02	kg CO_2e/kg disposed	1.3
	Steel Utility Poles	24,000	kg	0.005	kg CO_2e/kg disposed	0.13
	12kV Splices	5.4	kg	3.16	kg CO_2e/kg disposed	0.02
	46kV Splices	53	kg	3.16	kg CO_2e/kg disposed	0.17
	Light Fixtures	85	kg	2.65	kg CO_2e/kg disposed	0.23
	Lightning Arrestors	90	kg	0.32	kg CO_2e/kg disposed	0.03
	Fuse and Fuse Mount on Transformer	312	kg	0.005	kg CO_2e/kg disposed	0.002
	Distributed Discrete I/O Module	5.4	kg	0.32	kg CO_2e/kg disposed	0.002
	Remote Terminal Units	4.3	kg	0.32	kg CO_2e/kg disposed	0.001
	Battery	368	kg	1.24	kg CO_2e/kg disposed	0.45
	Battery Cabinet	544	kg	0.005	kg CO_2e/kg disposed	0.003
	Battery Charger	55	kg	0.32	kg CO_2e/kg disposed	0.018
	Circuit Breaker	318	kg	0.32	kg CO_2e/kg disposed	0.10
	Substation - Bulk of System - Aluminum	200	kg	0.015	kg CO_2e/kg disposed	0.003
	Substation - Bulk of System - Steel	10,240	kg	0.005	kg CO_2e/kg disposed	0.05
Decommissioning	System Decommissioning[10]					22
					Total Emissions	**41**

Ramboll

EXHIBIT 14
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Appendix Table A5
Decommissioning & Disposal GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

Notes:

1. Project specifications, assumptions and references are provided in Table 2.
2. The GHG emission factor for the Overhead Transmission Line Conductor - Bulk of System and Substation - Bulk of System - Aluminum is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., treatment of scrap aluminum, municipal incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.
3. The GHG emission factors for the fiber optic cable, switchgears, transformers, lightning arrestors, distributed discrete I/O module, remote terminal units, battery charger, and circuit breaker are calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for used industrial electronic device, WEEE collection, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.
4. The GHG emission factor for the manholes is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., treatment of waste concrete, inert material landfill, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.
5. The GHG emissions factor for the manhole covers, steel utility poles, fuse and fuse mount on transformer, battery cabinet, and Substation - Bulk of System - Steel is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., treatment of scrap steel, inert material landfill, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.
6. The GHG emission factor for the wood utility poles is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., treatment of wood pole, chrome preserved, municipal incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.
7. The GHG emission factor for 12kV and 46kV splices is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., treatment of waste rubber, unspecified, municipal incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.
8. The GHG emission factor for the light fixtures is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., treatment of hazardous waste, hazardous waste incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.
9. The GHG emissions factor for the batteries is calculated from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for used Li-ion battery, GLO, Allocation, cut-off by classification, ecoinvent database version 3.4, which is assumed to be representative of the Project's batteries.
10. Decommissioning emissions are assumed to be 3% of construction emissions. This assumption is based on GHG emissions estimated for construction and deconstruction phases for the Southern California Edison's Lakeview Substation Project. The Southern California Edison's Lakeview Substation Project reported the emissions associated with the construction and deconstruction of two existing substations. The substation that yielded the largest decommissioning intensity, calculated as the ratio of the deconstruction to the construction emissions, was used for this Project, which resulted in a decommissioning intensity of 3% of total construction emissions.

Abbreviations:

CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalence
GHG - greenhouse gas
GLO - global
GWP - global warming potentials

IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
kV - kilovolt
MT - metric ton
RoW - rest of world
WEEE - Waste Electrical and Electronic Equipment

Appendix Table A5
Decommissioning & Disposal GHG Emissions Calculations
Ho'opili Substation GHG Analysis
O'ahu, HI

References:

Doka, G., treatment of hazardous waste, hazardous waste incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.

Doka, G., treatment of scrap aluminum, municipal incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.

Doka, G., treatment of waste concrete, inert material landfill, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.

Doka, G., treatment of waste rubber, unspecified, municipal incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.5.

Doka, G., treatment of waste wood pole, chrome preserved, municipal incineration, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.

Hischier, R., market for used industrial electronic device, WEEE collection, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.

Hischier, R., market for used Li-ion battery, GLO, Allocation, cut-off by classification, ecoinvent database version 3.4.

Hischier, R., treatment of inert material landfill, scrap steel, RoW, Allocation, cut-off by classification, ecoinvent database version 3.4.

Intergovernmental Panel on Climate Change (IPCC), Fifth Assessment Report (AR5), 2014.

Southern California Edison's Lakeview Substation Project. 2012. Prepared for California Public Utilities Commission. Available at: https://www.cpuc.ca.gov/Environment/info/esa/lakeview/DEIR/Lakeview_SS_Apps.pdf. Accessed: November 2019.

EXHIBIT 15 – CONFIDENTIALITY JUSTIFICATION TABLE

Hawaiian Electric Company, Inc. hereby identifies redacted confidential and/or proprietary financial information that will be submitted confidentially upon issuance of a Protective Order in this docket ("Protective Order"). The following identifies, in reasonable detail, the confidential information's source, character, and location; (2) states clearly the basis for the claim of confidentiality; and (3) describes, with particularity, the cognizable harm to the producing party or participant from any misuse or unpermitted disclosure of the information.

Reference	**Identification of Item**	**Basis of Confidentiality**	**Harm**

EXHIBIT 15 – CONFIDENTIALITY JUSTIFICATION TABLE

Reference	Identification of Item	Basis of Confidentiality	Harm
Application, page 18; Exhibit 2; and Exhibit 11, Appendix A.	RFP results	Confidential and/or proprietary commercial and financial information which falls under the frustration of legitimate government function[1] exception of the Uniform Information Practices Act ("UIPA").	Public disclosure of the subject confidential and proprietary information provided to the Company pursuant to a confidentiality and non-disclosure agreement, which includes information on Developer's confidential project proposal, would place Developer at a competitive disadvantage because such disclosure could adversely affect Developer's ability to negotiate with vendors, contractors, and other parties who could use such information to Developer's disadvantage. In addition, such disclosure would provide Developer's competitors with insight into development strategies that could place Developer at a competitive disadvantage. Public disclosure could also jeopardize the Company in current or future competitive procurements, as disclosure of this information could dissuade the market from providing competitive proposals for renewable generation and storage and/or give an unfair business advantage to other potential bidders, resulting in increased costs or other prejudice to the Company and its customers. The Company maintains that the subject information falls under the frustration of legitimate government function exception of the UIPA, as disclosure of the subject information would impair the Commission's ability to obtain necessary information to properly perform its review of this regulatory proceeding (as the Company would not have submitted the confidential information in this docket at this time but for: (1) the governmental function of reviewing the Company's RFP; and (2) the Company's belief and reliance that the information would not be publicly disclosed). The confidential information: (1) has not been previously disclosed or otherwise publicly disseminated; (2) is not of the kind of information that the Company would customarily disclose to the public at this juncture; and (3) is of a nature that its disclosure could (a) impair the Commission's ability to obtain necessary information from similarly situated parties in the future, and (b) cause substantial harm to Developer, the Company, and/or its customers as previously described above.

[1] HRS § 92F-13(3).

EXHIBIT 15 – CONFIDENTIALITY JUSTIFICATION TABLE

Reference	Identification of Item	Basis of Confidentiality	Harm
Exhibit 5 – Land & Easement Acquisitions Exhibit 9 – Underground / Overhead Correspondence	Personal email addresses and/or telephone and facsimile numbers contained in correspondence	Personal identification information which falls under the unwarranted invasion of personal privacy exception in Section 92F-13(1) of the UIPA.	Public disclosure of the information could constitute an invasion of personal privacy and expose the person(s) to, among other things, potential victimization, and potentially expose the Company to potential liabilities, as well as the cost of addressing any potential untoward uses of the confidential information, and could also harm the Company's relationships with existing and/or prospective vendors and customers.

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAI'I

In the Matter of the Application of HAWAIIAN ELECTRIC COMPANY, INC. for approval to commit funds in excess of $2,500,000 (excluding customer contributions) for Project Item PZ.005089, Kulanihakoi Substation Project, and to recover costs through the Major Project Interim Recovery Adjustment Mechanism.	)	Docket No.

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing Application, Verification and Exhibits 1-15, together with this Certificate of Service, were duly served on the following party, by electronic mail service as set forth below:

Division of Consumer Advocacy
Department of Commerce and Consumer Affairs
335 Merchant Street, Room 326
Honolulu, Hawai'i 96813
dnishina@dcca.hawaii.gov
consumeradvocate@dcca.hawaii.gov

DATED: Honolulu, Hawai'i, November 4, 2020.

/s/ Lani Wong
Lani Wong
HAWAIIAN ELECTRIC COMPANY, INC.
Regulatory Affairs

FILED

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COMMISSION

The foregoing document was electronically filed with the State of Hawaii Public Utilities Commission's Document Management System (DMS).